

Berekening is akkoord


10-06-2024



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Aandachtspunt: De gemeente heeft voor deze berekening gekozen. Constructiebureau MUC heeft ook berekening gemaakt voor nieuwe damwanden maar gemeente heeft voor de berekening van Vlagsma b.v.

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Revisie:	0.0	
Status:	Definitief	
Opdrachtgever:	<b>Gemeente Zaanstad Stadhuisplein 100 1506 MZ Zaandam</b>	
Projectnummer:	<b>24-4942</b>	
Werk:	<b>Stalen damwand Gerrit Bolkade Zaandam</b>	
Onderdeel:	<b>Berekening stalen damwand</b>	
Ber. blz.:	1 t/m 6	
Uitgevoerd:	[redacted]	27-5-2024 
Datum:	27 mei 2024	

**Inhoudsopgave**

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Projectnummer: 24-4942  
 Onderdeel: Stalen damwand Gerrit Bolkade Zaandam  
 Versie: 0.0  
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 Opdrachtgever: Gemeente Zaanstad  
 Auteur: XXXXXXXXXX  
 Datum: 27-5-2024

## 1. Inleiding

Aan de Gerrit Bolkade in Zaandam wordt een nieuwe damwand aangebracht op een afstand van 1 m voor de bestaande damwand. Tevens wordt de damwand over een grotere lengte aangebracht.

De damwand wordt verankerd met groutankers.

## 2. Uitgangspunten

### 2.1 Normen

-NEN-EN 1990+A1+A1/C2 + NB: 2019  
 -NEN-EN 1991-1-1+C1 + NB: 2019  
 -NEN-EN 1992-1-1+C2 + NB: 2020  
 -NEN-EN 1993-1-1+C2 + NB: 2016  
 -NEN-EN 1997-1+C1+A1 + NB: 2016  
 -NEN-EN 9997-1 + C2: 2017

### 2.2 Resultaatsklasse

volgens NEN-EN 9997-1 combinatie A2:		$\gamma_V$	1,0
partiële factoren voor belastingen:	combinatie A2:	$\gamma_G$	1,0
		$\gamma_Q$	1,3
partiële factoren voor grondparameters:	set M2 RC2	$\gamma_\phi$	1,175 ( $\tan\phi'$ )
		$\gamma_c$	1,5
partiële factoren voor stijfheidsparameters:	set M2	$\gamma_E$	1,3

### 2.3 Materialen

levensduur: levensduur: 50 jaar voor zout water  
 corrosie in de bodem: 0,012 mm/jaar  
 t.p.v. waterlijn: 50\*0,018 0,90 mm  
 permanent onder water: 50\*0,012 0,60 mm  
 ongeroerde bodem: 50\*0,012 0,60 mm  
 opm. -corrosie schoon water (rond de waterspiegel) is niet maatgevend  
 -het maatgevend moment treedt op onder de waterlijn  
 staalkwaliteit: stalen damwand: S355  
 gording: S355  
 damwand: ZZ 18-700 (Gooimeer)  
 gording: He360B  
 ankers: Leeuwanker  $\phi 101,6 \times 22,2$  lang ca. 31 m o.g.  
 helling: 45°

**2.4 Kanaalpeilen**

Noordzeekanaal	hws	1,70	m+NAP	
	lws	0,40	m-NAP	
bodemhoogte		5,74	m-NAP	(bij sondering 1)

**2.5 Beschikbare documenten**

-grondonderzoek Willem Thomassenhaven Lankelma werknummer 18279



### 3. Stalen damwand

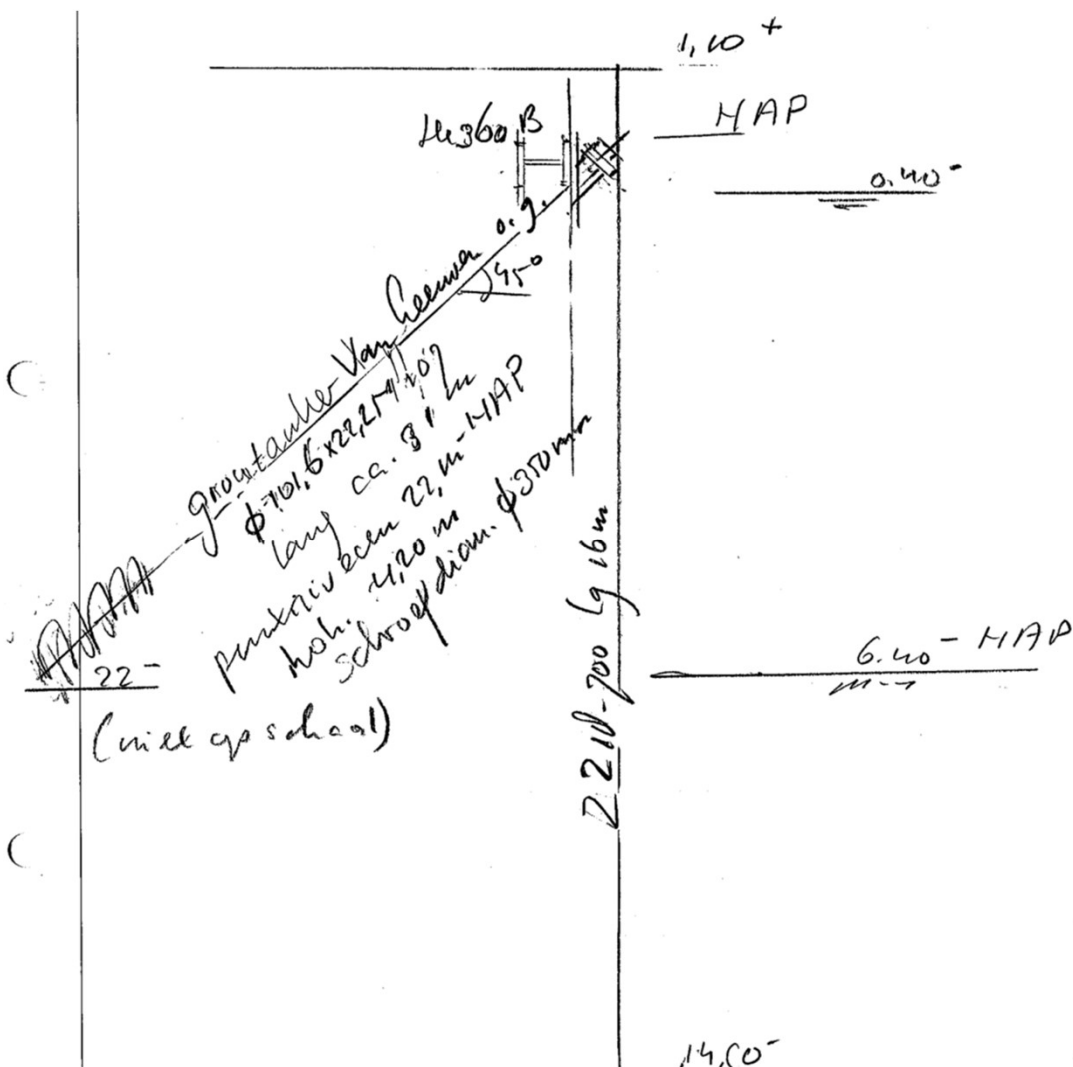
De bestaande stalen damwand wordt verlengd.

#### Uitgangspunten:

- veiligheidsklasse: RC2
- peil bovenzijde: 1,10m+NAP;
- waterstand: 0,40 m-NAP;
- waterdiepte 6,4 m-NAP;
- bovenbelasting: 20 kN/m<sup>2</sup>;
- bovenbelasting: 20 kN/m<sup>2</sup>;
- profiel ZZ 18-700, inheinniveau 14,9 m-NAP.
- verankering d.m.v. groutankers;
- gording He360B, staalkwaliteit S355

#### corrosie:

- levensduur: 50 jaar
- afname wanddikte:
- ter hoogte van waterlijn: 0,9 mm is niet maatgevend
- permanent onder water: 0,6 mm maatgevend
- verontreinigde bodem: 1,5 mm is niet maatgevend
- ongeroerde bodem: 0,6 mm maatgevend



**3.1 Grondparameters**

sondering 1 is maatgevend.

**Grondopbouw met parameters**

bk laag m NAP	grondsoort	$q_c$ MN/m <sup>2</sup>	$\gamma$	$\varphi$	$\varphi_d$	secant beddingsconstante		
						$k_1$ MN/m <sup>2</sup>	$k_2$ MN/m <sup>3</sup>	$k_3$ MN/m <sup>3</sup>
1,1	straatwand	1,0	18	27,5	23,9	12	6	3
0,0	klei	0,5	16	15	12,8	2	1	1
-7,2	zand sterk siltig	4,0	17	27,5	23,9	6	3	12
-8,0	leem 1	1,5	18	27,5	23,9	6	4	2
-9,0	zand los	4,0	19	27,5	23,9	12	6	3
-12,0	leem 2	1,0	19	27,5	23,9	4	2	1
-12,5	zand matig vast	12,0	20	30	26,2	20	10	5
-15,0	leem 2	1,0	19	27,5	23,9	4	2	1
-15,5	zand los	6,0	20	30	26,2	12	6	3
-19,0	zand matig vast	16,0	20	30	26,2	20	10	5

**gemiddelde conuswaarden t.b.v. ankerberekening**

sondering	1				2				3			
	diepte	$q_c$	$h$	$\Sigma q_c$	diepte	$q_c$	$h$	$\Sigma q_c$	diepte	$q_c$	$h$	$\Sigma q_c$
	m-NAP	MN/m <sup>2</sup>	m		m-NAP	MN/m <sup>2</sup>	m		m-NAP	MN/m <sup>2</sup>	m	
	-13,2	12	1,6	19	-15,5	7	3,1	22	-13,2	12	1,5	18
	-14,8	22	0,5	11	-18,6	14	3	42	-14,7	22	0,5	11
	-15,3	11,5	0,7	8	-21,6	6	0,4	2	-15,2	12	0,8	10
	-16	8	3,5	28	-22	20	1,2	24	-16	7	2	14
	-19,5	16	2,5	40	-23,2				-18	10	1	10
	-22								-19	8	1	8
		11,3	6	68		14,9	4,6	68	-20	17	2	34
									-22			
										11,0	6	66
lengte ankerlichaam:			8,5				6,5				8,5	

wordt niet meegerekend vanwege te grote lengte ankerlichaam

4				5			
diepte	$q_c$	$h$	$\Sigma q_c$	diepte	$q_c$	$h$	$\Sigma q_c$
m-NAP	MN/m <sup>2</sup>	m		m-NAP	MN/m <sup>2</sup>	m	
-14,7	5	3	15	-16,2	21	1,1	23
-17,7	20	1,8	36	-17,3	14	0,7	10
-19,5	11	1	11	-18	18	0,7	13
-20,5	26	1,5	39	-18,7	12	0,3	4
-22				-19	19	0,4	7,6
				-19,4	24	2,6	62
				-22			
	20,0	4,3	86		20,5	5,8	119
lengte ankerlichaam:		6,1				8,2	

**3.2 Groutankers**

leverancier: Van Leeuwen

type	anker	moer	schr.	t	A*	staal	F <sub>a,max</sub>	hoh	R <sub>a;d</sub>	R <sub>s;d</sub>	uc
			mm	mm	mm <sup>2</sup>		kN	m	kN	kN	
850	φ101,6*12,5	M107	350	12,5	3270	MW450	1230	4,2	1583	1464	1,19
1000	φ82,5*22,2	M87	250	22,2	3904	MW450	1468	4,2	1144	1464	1,28
1400	φ101,6*22,2	M107	350	22,2	5309	MW450	1996	4,2	1583	1464	0,92
schr. = schroefblad					* na corrosie:			0,6	mm		
t =		wanddikte									

lengte ankerlichaam: 8,5 m  $\Sigma q_c$  66,0 MN/m

diepte: 22 m

lengte anker: ca. 31,2 m

partiële materiaalfactor:  $\gamma_a$  1,2reductiefactor:  $\xi_a$  1 op alle ankers controleproef uitvoeren

belastingfactor controle ankerstaaf: 1,25

belastingfactor controle gording: 1,1 bij calamiteit: 1,0

**3.3 Stalen damwand**

	A	I	W	$t_{flens}$	$t_{ijf}$	S	$M_{u;d}$
	cm <sup>2</sup>	cm <sup>4</sup>	cm <sup>3</sup>	mm	mm	N/mm <sup>2</sup>	kNm
ZZ18-700	139,2	38001	1807	9,1	9,0	S355	641
afname:		32990	1569	7,9	7,8	S355	557

	$M_{s;d}$	$M_{u;d}$	uc		$Q_{s;d}$	$Q_{u;d}$	uc	vervorming:
	kNm	kNm			kNm	kNm		δ
ZZ18-700	571	557	1,03	< 1	371,5	243	1151	0,21
								< 1
								56,8

kleine overschrijding, is acceptabel

voorspanning: 350 kN d.i. 83,3 kN/m

ankerkracht: 1464 kN d.i. 348,6 kN/m type 800

**3.4 Stalen gording**

				uc				uc
$M_d = 0,1 \cdot q \cdot l^2$	$M_{s;d}$	478	kNm	0,65	< 1	$Q_{s;d}$	230	kN
							0,70	< 1

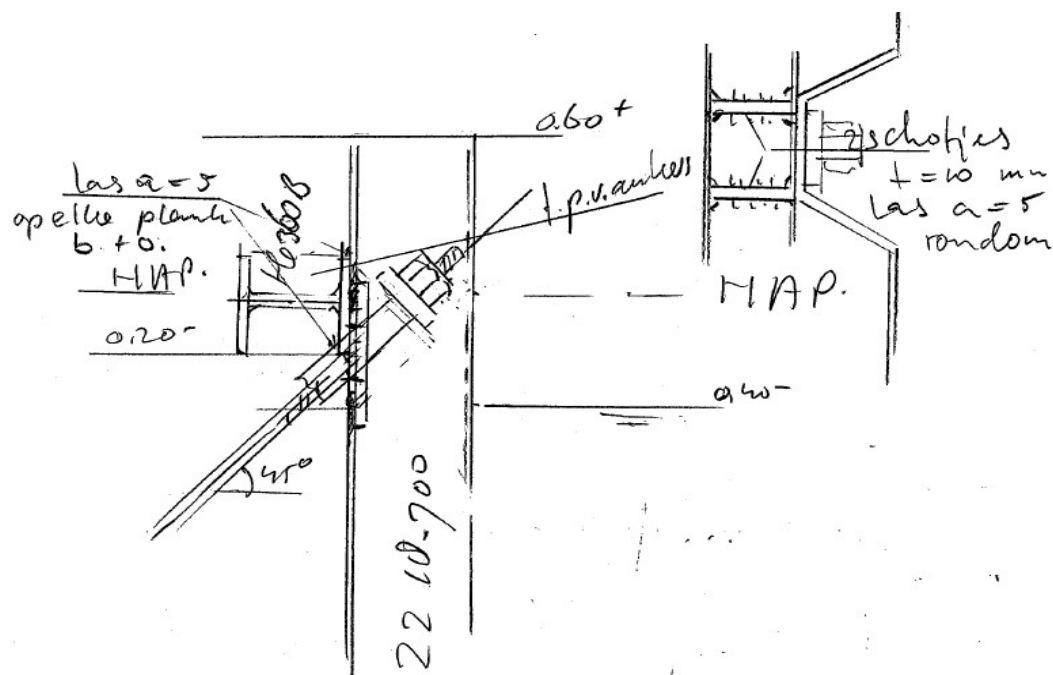
gording He360B:	$M_{y;el;d}$	738	kNm		$Q_{u;d}$	331	kN
	$M_{y;pl;d}$	825	kNm				

gording bij elke plank boven- en onder lassen a=5 lang 300 mm, kip is daarmee verzekerd voor inleiding ankerkracht 2 schotjes per anker inlassen

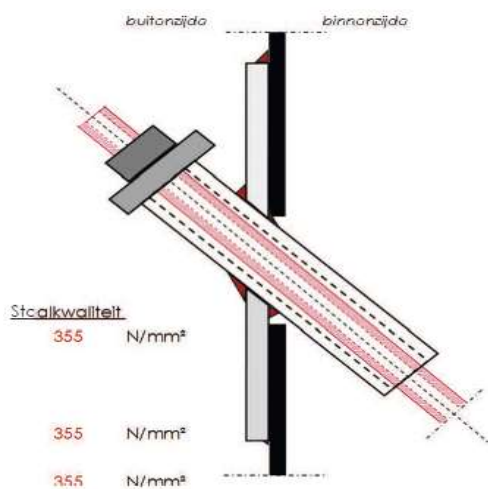
He360B voor corrosie: He360B na corrosie:

A	180,6	cm <sup>2</sup>	A	152,8	cm <sup>2</sup>
$W_{y;el}$	2400	cm <sup>3</sup>	$W_{y;el}$	2080	cm <sup>3</sup>
$W_{y;pl}$	2683	cm <sup>3</sup>	$W_{y;pl}$	2325	cm <sup>3</sup>

### 3.5 Details



De ankerstoel is volgens detail van de leverancier:



Documentnummer: 4942-02  
Revisie: **0.0**

Opdrachtgever: Gemeente Zaanstad  
Stadhuisplein 100  
1506 MZ Zaandam

Projectnummer: 24-4942

Werk: Stalen damwand Gerrit Bolkade Zaandam  
Berekening stalen damwand

Onderdeel: **Bijlage 1**  
**stalen damwand**  
**DSheet 22.1**

Datum: 27 mei 2024

## Report for D-Sheet Piling 22.1

Design of Diaphragm and Sheet Pile Walls  
Developed by Deltares



Company: ingenieursbureau Vlagsma bv

Date of report: 27-5-2024

Time of report: 14:59:53

Report with version: 22.1.1.35825

Date of calculation: 27-5-2024

Time of calculation: 14:58:33

Calculated with version: 22.1.1.35825

File name: 4942-Zaandam-stalen damwand-AZ18-700

Project identification: Zaandam stalen damwand  
AZ18-700

Verification according to National Annex of Eurocode 7 in the Netherlands (NEN 9997-1:2016)

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## 2 Summary

### 2.1 Overview per Stage and Test

Stage nr.	Verification type	Displacement [mm]	Moment [kNm]	Shear force [kN]	Mob. perc. moment [%]	Mob. perc. resistance [%]	Status
1	EC7(NL)-Step 6.3		422,51	164,97	40,7	45,1	
1	EC7(NL)-Step 6.4		382,62	-160,90	40,9	45,8	
1	EC7(NL)-Step 6.5	34,6	256,76	-119,25	23,0	26,3	
1	EC7(NL)-Step 6.5 x 1,200		308,12	-143,10			
2	EC7(NL)-Step 6.3		445,49	159,55	41,2	45,6	
2	EC7(NL)-Step 6.4		405,06	-166,16	41,4	46,3	
2	EC7(NL)-Step 6.5	35,2	254,91	-119,31	23,0	26,3	
2	EC7(NL)-Step 6.5 x 1,200		305,89	-143,17			
3	EC7(NL)-Step 6.3		<b>570,83</b>	<b>226,95</b>	48,9	53,5	
3	EC7(NL)-Step 6.4		522,01	216,39	<b>50,7</b>	<b>55,8</b>	
3	EC7(NL)-Step 6.5	<b>48,6</b>	338,23	156,96	26,5	30,3	
3	EC7(NL)-Step 6.5 x 1,200		405,88	188,36			

Max		<b>48,6</b>	<b>570,83</b>	<b>226,95</b>	<b>50,7</b>	<b>55,8</b>	
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Stage nr.	Verification type	Vertical balance
1	EC7(NL)-Step 6.3	Sufficient
1	EC7(NL)-Step 6.4	Sufficient
1	EC7(NL)-Step 6.5	Sufficient
1	EC7(NL)-Step 6.5 x 1,200	
2	EC7(NL)-Step 6.3	Sufficient
2	EC7(NL)-Step 6.4	Sufficient
2	EC7(NL)-Step 6.5	Sufficient
2	EC7(NL)-Step 6.5 x 1,200	
3	EC7(NL)-Step 6.3	Not sufficient
3	EC7(NL)-Step 6.4	Not sufficient
3	EC7(NL)-Step 6.5	Sufficient
3	EC7(NL)-Step 6.5 x 1,200	

Summary		Not sufficient
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### 2.2 Anchors and Struts

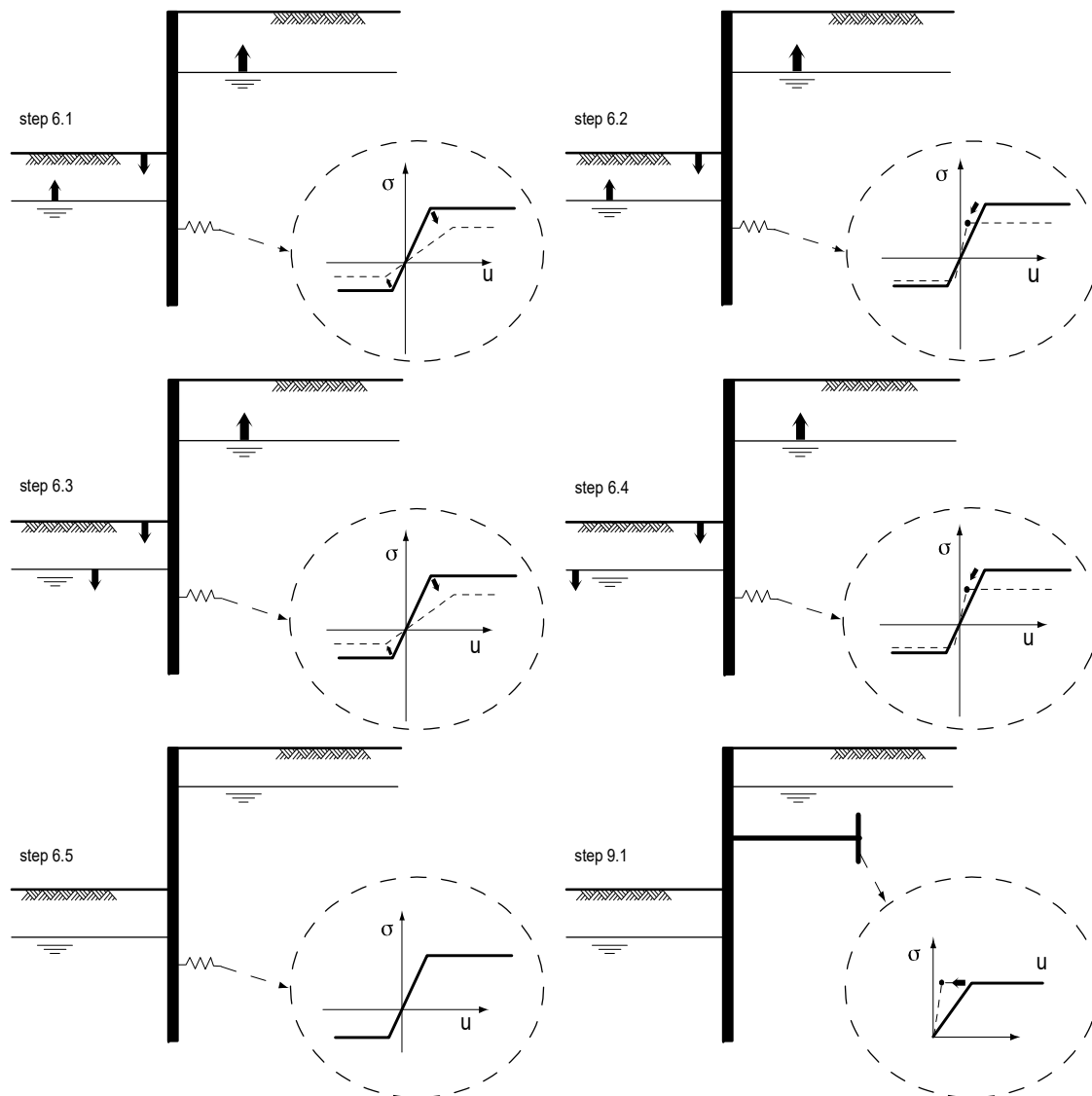
Stage nr.	Verification type	Anchor/strut		
		Force [kN]	State	Status
1	EC7(NL)-Step 6.3	243,80	Elastic	
1	EC7(NL)-Step 6.4	231,34	Elastic	
1	EC7(NL)-Step 6.5 x 1,200	207,63	Elastic	
2	EC7(NL)-Step 6.3	175,00	Elastic	
2	EC7(NL)-Step 6.4	175,00	Elastic	
2	EC7(NL)-Step 6.5 x 1,200	210,00	Elastic	
3	EC7(NL)-Step 6.3	<b>348,57</b>	Elastic	
3	EC7(NL)-Step 6.4	333,71	Elastic	
3	EC7(NL)-Step 6.5 x 1,200	293,37	Elastic	

Max		<b>348,57</b>		
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## 2.3 Overall Stability per Stage

Stage name	Stability factor [-]
New Stage 1	2,25
New Stage 2	2,25
New Stage 3	1,94

## 2.4 CUR Verification Steps



### 3 Input Data for all Stages

#### 3.1 General Input Data

Verification according to National Annex of Eurocode 7 in the Netherlands (NEN 9997-1:2016)

Model	Sheet piling
Check vertical balance	Yes
Number of construction stages	3
Unit weight of water	9,81 kN/m <sup>3</sup>
Number of curves for spring characteristics	3
Unloading curve on spring characteristic	No
Elastic calculation	Yes

#### 3.2 Sheet Piling Properties

Length	16,00 m
Level top side	1,10 m
Number of sections	1
q <sub>b,max</sub>	20,00 MPa
Xi factor	1,39

##### 3.2.1 General Properties

Section name	From [m]	To [m]	Material type	Acting width [m]
AZ18-700	-14,90	1,10	User defined	1,40

##### 3.2.2 Stiffness EI (elastic behaviour)

Section name	Elastic stiffness EI [kNm <sup>2</sup> /m']	Red. factor on EI [-]	Corrected elas. stiffness EI [kNm <sup>2</sup> ]	Note to reduction factor
AZ18-700	7,9380E+04	1,00	1,1113E+05	1

##### 3.2.3 Maximum Allowable Moments

Section name	Mr <sub>char;el</sub> [kNm/m']	Modification factor [-]	Material factor [-]	Red. factor allow. moment [-]	Mr <sub>d;el</sub> [kNm]
AZ18-700	639,00	1,00	1,00	1,00	894,60

##### 3.2.4 Properties for Vertical Balance

Section name	From [m]	To [m]	Height [mm]	Section area [cm <sup>2</sup> /m']
AZ18-700	-14,90	1,10	420,00	194,60

#### 3.3 Calculation Options

First stage represents initial situation	No
Calculation refinement	Coarse
Reduce delta(s) according to CUR	Yes
Verification	EC7 NA NL - method A: Partial factors (design values) in all stages. Eurocode 7 using the factors as described in the National Annex of the Netherlands. It is basically design approach III.
Multiplication factor for anchor stiffness	1,000
Used partial factor set	RC 2

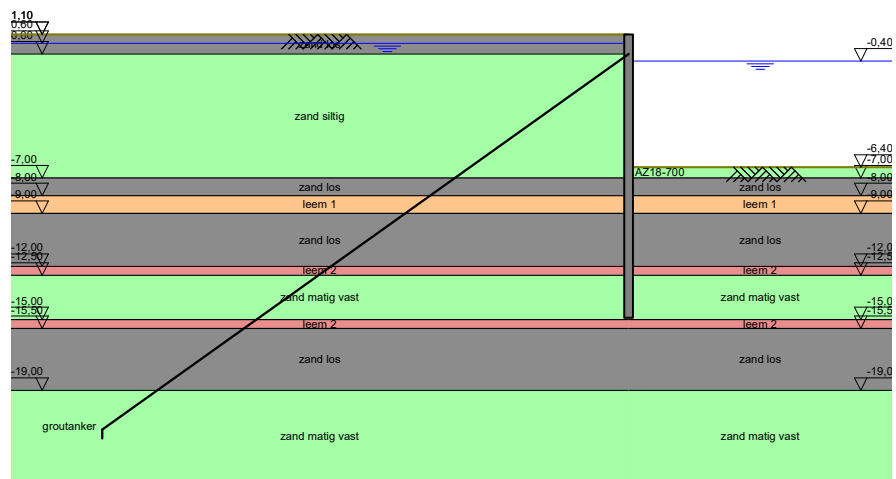
Factors on loads - Geotechnical loads	
- Permanent load, unfavourable	1,000
- Permanent load, favourable	1,000
- Variable load, unfavourable	1,100
- Variable load, favourable	0,000
Factors on loads - Constructive loads	
- Permanent load, unfavourable	1,350
- Permanent load, favourable	0,900
- Variable load, unfavourable	1,500
- Variable load, favourable	0,000
Material factors	
- Cohesion	1,250
- Tangent phi	1,175
- Delta (wall friction angle)*	1,175
- Modulus of low representative subgrade reaction	1,300
Geometry modification	
- Increase retaining height	10,00 %
- Maximum increase retaining height	0,50 m
- Reduction in phreatic line on passive side**	0,25 m
- Raise in phreatic line on passive side**	0,25 m
- Raise in phreatic line on active side	0,05 m
Factors on representative values	
- Partial factor on M, D and Pmax	1,200
Overall stability factors	
- Cohesion	1,450
- Tangent phi	1,250
- Factor on unit weight soil	1,000
Vertical balance factors	
- Partial factor base resistance (gamma_b)	1,200

\* For delta (wall friction angle), the input value of tangent phi is used

\*\* This modification of the phreatic level does not apply when the sheet piling is completely submerged.

## 4 Outline Stage 1: New Stage 1

Outline - Stage 1: New Stage 1

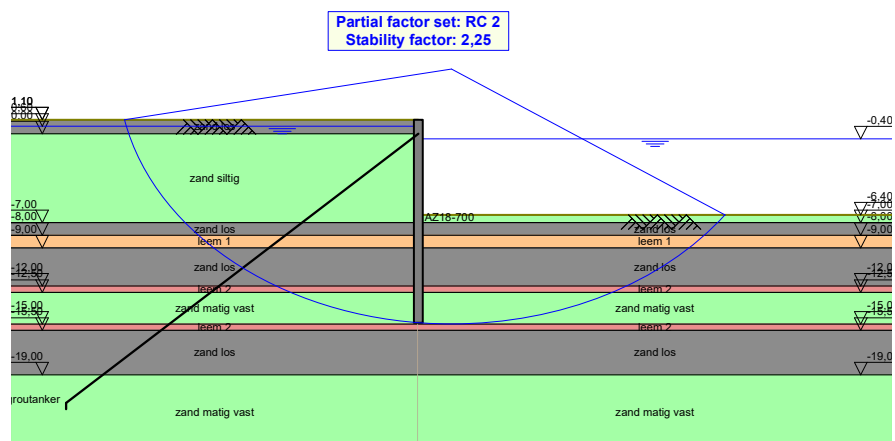


## 5 Overall Stability Stage 1: New Stage 1

Stability factor : 2,25

### 5.1 Overall Stability

Overall Stability - Stage 1: New Stage 1



## 6 Step 6.3 Stage 1: New Stage 1

### 6.1 General Input Data

Passive side:

D-Sheet Piling determined

### 6.2 Input Data Left

#### 6.2.1 Calculation Method

Calculation method: C, phi, delta

#### 6.2.2 Water Level

Water level: 0,65 [m]

#### 6.2.3 Surface

X [m]	Y [m]
0,00	1,10

#### 6.2.4 Soil Material Properties in Profile: kade

Layer name	Level [m]	Unit weight	
		Unsat [kN/m³]	Sat. [kN/m³]
zand los	1,10	18,00	19,00
zand siltig	0,00	17,00	18,00
zand los	-7,00	18,00	19,00
leem 1	-8,00	19,00	18,00
zand los	-9,00	18,00	19,00
leem 2	-12,00	19,00	19,00
zand matig vast	-12,50	18,00	20,00
leem 2	-15,00	19,00	19,00
zand los	-15,50	18,00	19,00
zand matig vast	-19,00	18,00	20,00

Layer name	Level [m]	Cohesion [kN/m²]	Friction angle phi [°]	Delta friction angle*	
				Not reduced [°]	Reduced [°]
zand los	1,10	0,00	23,90	17,38	17,38
zand siltig	0,00	0,00	21,65	13,85	13,85
zand los	-7,00	0,00	23,90	17,38	17,38
leem 1	-8,00	0,00	23,90	17,38	17,38
zand los	-9,00	0,00	23,90	17,38	17,38
leem 2	-12,00	0,00	23,90	17,38	17,38
zand matig vast	-12,50	0,00	26,17	17,45	17,45
leem 2	-15,00	0,00	23,90	17,38	17,38
zand los	-15,50	0,00	23,90	17,38	17,38
zand matig vast	-19,00	0,00	26,17	17,45	17,45

\* The 'not reduced' Delta angle is used for the calculation of the active earth pressure coefficient of Culmann whereas the 'reduced' Delta angle is used for the passive earth pressure coefficient.

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
zand los	1,10	1,00	1,00	Fine
zand siltig	0,00	1,00	1,00	Fine
zand los	-7,00	1,00	1,00	Fine
leem 1	-8,00	1,00	1,00	Fine
zand los	-9,00	1,00	1,00	Fine
leem 2	-12,00	1,00	1,00	Fine
zand matig vast	-12,50	1,00	1,00	Fine

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
leem 2	-15,00	1,00	1,00	Fine
zand los	-15,50	1,00	1,00	Fine
zand matig vast	-19,00	1,00	1,00	Fine

Layer name	Level [m]	Earth pressure coefficients			Additional pore pressure	
		Active [-]	Neutral [-]	Passive [-]	Top [kN/m²]	Bottom [kN/m²]
zand los	1,10	n.a.	n.a.	n.a.	0,00	0,00
zand siltig	0,00	n.a.	n.a.	n.a.	0,00	0,00
zand los	-7,00	n.a.	n.a.	n.a.	0,00	0,00
leem 1	-8,00	n.a.	n.a.	n.a.	0,00	0,00
zand los	-9,00	n.a.	n.a.	n.a.	0,00	0,00
leem 2	-12,00	n.a.	n.a.	n.a.	0,00	0,00
zand matig vast	-12,50	n.a.	n.a.	n.a.	-10,00	-10,00
leem 2	-15,00	n.a.	n.a.	n.a.	-10,00	-10,00
zand los	-15,50	n.a.	n.a.	n.a.	-10,00	-10,00
zand matig vast	-19,00	n.a.	n.a.	n.a.	-10,00	-10,00

### 6.2.5 Modulus of Subgrade Reaction (Secant)

Layer name	Level [m]	Branch 1		Branch 2	
		Top [kN/m³]	Bottom [kN/m³]	Top [kN/m³]	Bottom [kN/m³]
zand los	1,10	9230,77	9230,77	4615,38	4615,38
zand siltig	0,00	9230,77	9230,77	4615,38	4615,38
zand los	-7,00	9230,77	9230,77	4615,38	4615,38
leem 1	-8,00	3076,92	3076,92	1538,46	1538,46
zand los	-9,00	9230,77	9230,77	4615,38	4615,38
leem 2	-12,00	9230,77	9230,77	4615,38	4615,38
zand matig vast	-12,50	15384,62	15384,62	7692,31	7692,31
leem 2	-15,00	9230,77	9230,77	4615,38	4615,38
zand los	-15,50	9230,77	9230,77	4615,38	4615,38
zand matig vast	-19,00	15384,62	15384,62	7692,31	7692,31

Layer name	Level [m]	Branch 3	
		Top [kN/m³]	Bottom [kN/m³]
zand los	1,10	2307,69	2307,69
zand siltig	0,00	2307,69	2307,69
zand los	-7,00	2307,69	2307,69
leem 1	-8,00	615,38	615,38
zand los	-9,00	2307,69	2307,69
leem 2	-12,00	2307,69	2307,69
zand matig vast	-12,50	3846,15	3846,15
leem 2	-15,00	2307,69	2307,69
zand los	-15,50	2307,69	2307,69
zand matig vast	-19,00	3846,15	3846,15

### 6.2.6 Anchors

Name	Level [m]	E-Modulus [kN/m²]	Cross section [m²/m']	Length [m]	Angle [°]	Yield force [kN/m']	Pre-tension. force [kN/m']
groutanker	0,00	2,100E+08	1,158E-03	30,00	-45,00	300,00	n.a.

### 6.3 Calculated Earth Pressure Coefficients Left

Segment number	Level [m]	Horizontal pressure		Fictive earth pressure coefficients		
		Active [kN/m²]	Passive [kN/m²]	Ka [-]	Ko [-]	Kp [-]
1	1,05	0,3	3,4	0,36	0,59	3,77
2	0,82	1,8	18,7	0,36	0,59	3,77
3	0,63	3,0	31,4	0,36	0,59	3,77
4	0,40	3,7	39,2	0,36	0,59	3,77
5	0,10	4,7	49,6	0,36	0,59	3,77



Segment number	Level [m]	Horizontal pressure		Fictive earth pressure coefficients		
		Active [kN/m <sup>2</sup> ]	Passive [kN/m <sup>2</sup> ]	Ka [-]	Ko [-]	Kp [-]
6	-0,20	6,3	48,5	0,40	0,63	3,09
7	-0,53	7,3	56,6	0,40	0,63	3,08
8	-1,05	9,1	69,6	0,40	0,63	3,08
9	-1,84	11,6	89,5	0,40	0,63	3,07
10	-2,63	14,2	109,4	0,40	0,63	3,07
11	-3,42	16,8	129,3	0,40	0,63	3,07
12	-4,21	19,4	149,2	0,40	0,63	3,07
13	-5,00	22,0	169,2	0,40	0,63	3,07
14	-5,65	24,1	185,4	0,40	0,63	3,07
15	-6,15	25,8	198,0	0,40	0,63	3,07
16	-6,65	27,4	210,6	0,40	0,63	3,07
17	-6,95	28,4	218,1	0,40	0,63	3,07
18	-7,25	26,3	279,9	0,36	0,59	3,80
19	-7,75	28,0	296,7	0,36	0,59	3,79
20	-8,25	29,5	312,8	0,36	0,59	3,78
21	-8,75	31,0	328,0	0,36	0,59	3,78
22	-9,38	33,0	348,5	0,36	0,59	3,78
23	-10,13	35,4	374,3	0,36	0,59	3,78
24	-10,88	37,9	400,2	0,36	0,59	3,77
25	-11,63	40,4	426,1	0,36	0,59	3,77
26	-12,25	42,4	447,7	0,36	0,59	3,77
27	-12,80	44,0	571,2	0,33	0,56	4,26
28	-13,40	46,0	596,9	0,33	0,56	4,26
29	-14,00	48,0	622,7	0,33	0,56	4,26
30	-14,60	50,0	648,5	0,33	0,56	4,26

#### 6.4 Calculated Force from a Layer - Left Side

Name	Force
zand los	3,23
zand siltig	119,66
zand los	27,16
leem 1	30,27
zand los	109,99
leem 2	21,21
zand matig vast	170,76
leem 2	0,00
zand los	0,00
zand matig vast	0,00

#### 6.5 Input Data Right

##### 6.5.1 Calculation Method

Calculation method: Ka, Ko, Kp

##### 6.5.2 Water Level

Water level: -0,65 [m]

##### 6.5.3 Surface

X [m]	Y [m]
0,00	-6,90

##### 6.5.4 Soil Material Properties in Profile: kanaalzijde

Layer name	Level [m]	Unit weight	
		Unsat [kN/m <sup>3</sup> ]	Sat. [kN/m <sup>3</sup> ]
zand siltig	-5,40	17,00	18,00
zand los	-7,00	18,00	19,00
leem 1	-8,00	19,00	18,00

Layer name	Level [m]	Unit weight	
		Unsat [kN/m³]	Sat. [kN/m³]
zand los	-9,00	18,00	19,00
leem 2	-12,00	19,00	19,00
zand matig vast	-12,50	18,00	20,00
leem 2	-15,00	19,00	19,00
zand los	-15,50	18,00	19,00
zand matig vast	-19,00	18,00	20,00

Layer name	Level [m]	Cohesion [kN/m²]	Friction angle phi [°]	Delta friction angle	
				Not reduced [°]	Reduced [°]
zand siltig	-5,40	0,00	21,65	13,85	n.a.
zand los	-7,00	0,00	23,90	17,38	n.a.
leem 1	-8,00	0,00	23,90	17,38	n.a.
zand los	-9,00	0,00	23,90	17,38	n.a.
leem 2	-12,00	0,00	23,90	17,38	n.a.
zand matig vast	-12,50	0,00	26,17	17,45	n.a.
leem 2	-15,00	0,00	23,90	17,38	n.a.
zand los	-15,50	0,00	23,90	17,38	n.a.
zand matig vast	-19,00	0,00	26,17	17,45	n.a.

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
zand siltig	-5,40	1,00	1,00	Fine
zand los	-7,00	1,00	1,00	Fine
leem 1	-8,00	1,00	1,00	Fine
zand los	-9,00	1,00	1,00	Fine
leem 2	-12,00	1,00	1,00	Fine
zand matig vast	-12,50	1,00	1,00	Fine
leem 2	-15,00	1,00	1,00	Fine
zand los	-15,50	1,00	1,00	Fine
zand matig vast	-19,00	1,00	1,00	Fine

Layer name	Level [m]	Earth pressure coefficients			Additional pore pressure	
		Active [-]	Neutral [-]	Passive [-]	Top [kN/m²]	Bottom [kN/m²]
zand siltig	-5,40	0,40	0,63	3,07	0,00	0,00
zand los	-7,00	0,36	0,59	3,77	0,00	0,00
leem 1	-8,00	0,36	0,59	3,77	0,00	0,00
zand los	-9,00	0,36	0,59	3,77	0,00	0,00
leem 2	-12,00	0,36	0,59	3,77	0,00	0,00
zand matig vast	-12,50	0,33	0,56	4,25	0,00	0,00
leem 2	-15,00	0,36	0,59	3,77	0,00	0,00
zand los	-15,50	0,36	0,59	3,77	0,00	0,00
zand matig vast	-19,00	0,33	0,56	4,25	0,00	0,00

### 6.5.5 Modulus of Subgrade Reaction (Secant)

Layer name	Level [m]	Branch 1		Branch 2	
		Top [kN/m³]	Bottom [kN/m³]	Top [kN/m³]	Bottom [kN/m³]
zand siltig	-5,40	9230,77	9230,77	4615,38	4615,38
zand los	-7,00	9230,77	9230,77	4615,38	4615,38
leem 1	-8,00	3076,92	3076,92	1538,46	1538,46
zand los	-9,00	9230,77	9230,77	4615,38	4615,38
leem 2	-12,00	9230,77	9230,77	4615,38	4615,38
zand matig vast	-12,50	15384,62	15384,62	7692,31	7692,31
leem 2	-15,00	9230,77	9230,77	4615,38	4615,38
zand los	-15,50	9230,77	9230,77	4615,38	4615,38
zand matig vast	-19,00	15384,62	15384,62	7692,31	7692,31

Layer name	Level [m]	Branch 3	
		Top [kN/m³]	Bottom [kN/m³]
zand siltig	-5,40	2307,69	2307,69
zand los	-7,00	2307,69	2307,69
leem 1	-8,00	615,38	615,38
zand los	-9,00	2307,69	2307,69
leem 2	-12,00	2307,69	2307,69
zand matig vast	-12,50	3846,15	3846,15
leem 2	-15,00	2307,69	2307,69
zand los	-15,50	2307,69	2307,69
zand matig vast	-19,00	3846,15	3846,15

## 6.6 Calculated Force from a Layer - Right Side

Name	Force
zand siltig	0,13
zand los	20,41
leem 1	45,33
zand los	271,31
leem 2	46,28
zand matig vast	141,45
leem 2	0,00
zand los	0,00
zand matig vast	0,00

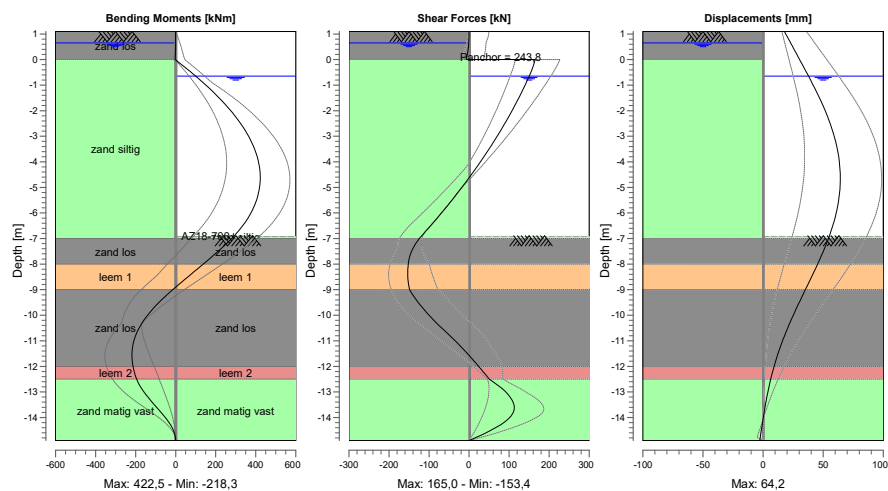
## 6.7 Calculation Results

Number of iterations: 5

### 6.7.1 Charts of Moments, Forces and Displacements

#### Moments/Forces/Displacements - Stage 1: New Stage 1

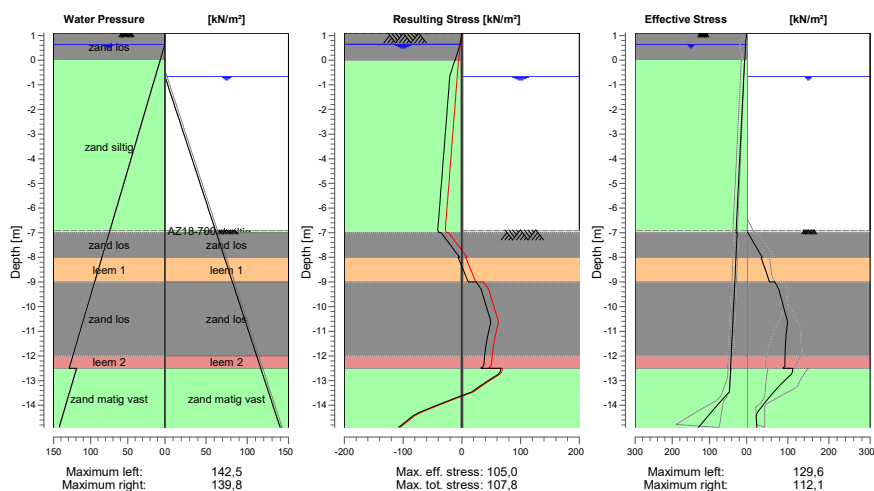
##### Step 6.3 - Partial factor set: RC 2



## 6.7.2 Charts of Stresses

### Stress States - Stage 1: New Stage 1

#### Step 6.3 - Partial factor set: RC 2



## 6.7.3 Percentage Mobilized Resistance

Horizontal soil pressure	Left [kN]	Right [kN]
Effective	675,2	734,9
Water	1626,9	1394,4
Total	2302,0	2129,3

Considered as passive side	Right
Maximum passive effective resistance	1630,47 kN
Mobilized passive effective resistance	734,87 kN
Percentage mobilized resistance	45,1 %
Position single support	0,00 m
Maximum passive moment	20153,87 kNm
Mobilized passive moment	8207,62 kNm
Percentage mobilized moment	40,7 %

## 6.7.4 Vertical Force Balance

Xi factor	1,39
Partial factor base resistance	1,20
Maximum point resistance	20,000 [MPa]

Vertical force balance unplugged	Force [kN]
Vertical force active	-200,50
Vertical force passive	230,23
Vertical anchor force *	-189,63
Resulting vertical force (no dead weight)	-159,90
Vertical toe capacity $R_{b;d}$	233,33
Vertical toe capacity is sufficient ( $160 \leq 233$ )	

Vertical force balance plugged	Force [kN]
Vertical force active	-200,50
Vertical force passive	230,23
Vertical anchor force	-189,63
Resulting vertical force (no dead weight)	-159,90
Vertical toe capacity $R_{b;d}$	7050,36
Vertical toe capacity is sufficient ( $160 \leq 7050$ )	

\* The vertical anchor force includes a factor of 1.1 as prescribed by art. 9.7.5(a) of Eurocode NEN 9997-1:2016.

### 6.7.5 Vertical Force Balance - Contribution per Layer

Left			Right		
Level [m]	Layer name	Contribution [kN]	Level [m]	Layer name	Contribution [kN]
1,10	zand los	-1,41	-5,40	zand siltig	0,04
0,00	zand siltig	-41,31	-7,00	zand los	8,94
-7,00	zand los	-11,90	-8,00	leem 1	19,86
-8,00	leem 1	-13,26	-9,00	zand los	118,87
-9,00	zand los	-48,19	-12,00	leem 2	20,28
-12,00	leem 2	-9,29	-12,50	zand matig vast	62,23
-12,50	zand matig vast	-75,12	-15,00	leem 2	0,00
-15,00	leem 2	0,00	-15,50	zand los	0,00
-15,50	zand los	0,00	-19,00	zand matig vast	0,00
-19,00	zand matig vast	0,00			

### 6.7.6 Anchors/Struts

Anchor/strut	Level [m]	E-Modulus [kN/m <sup>2</sup> ]	Force [kN]	State	Side	Type
groutanker	0,00	2,100E+08	243,80	Elastic	Left	Anchor

## 7 Step 6.5 Stage 1: New Stage 1

### 7.1 General Input Data

Passive side:

D-Sheet Piling determined

### 7.2 Calculated Earth Pressure Coefficients Left

Segment number	Level [m]	Horizontal pressure		Fictive earth pressure coefficients		
		Active [kN/m <sup>2</sup> ]	Passive [kN/m <sup>2</sup> ]	Ka [-]	Ko [-]	Kp [-]
1	1,05	0,3	4,5	0,31	0,54	4,96
2	0,80	1,7	26,8	0,31	0,54	4,96
3	0,40	3,3	53,8	0,31	0,54	4,96
4	0,10	4,2	67,5	0,31	0,54	4,96
5	-0,20	5,6	62,4	0,35	0,58	3,87
6	-0,76	7,2	79,7	0,35	0,58	3,85
7	-1,47	9,2	102,0	0,35	0,58	3,84
8	-2,19	11,3	124,3	0,35	0,58	3,84
9	-2,90	13,3	146,7	0,35	0,58	3,83
10	-3,61	15,3	169,1	0,35	0,58	3,83
11	-4,33	17,4	191,5	0,35	0,58	3,83
12	-5,04	19,4	213,9	0,35	0,58	3,83
13	-5,65	21,1	233,0	0,35	0,58	3,83
14	-6,15	22,6	248,7	0,35	0,58	3,83
15	-6,70	24,1	266,0	0,35	0,58	3,83
16	-7,25	22,7	372,5	0,31	0,54	5,02
17	-7,75	24,1	394,2	0,31	0,54	5,01
18	-8,25	25,5	415,0	0,31	0,54	4,99
19	-8,75	26,7	434,8	0,31	0,54	4,99
20	-9,38	28,4	461,6	0,31	0,54	4,98
21	-10,13	30,5	495,5	0,31	0,54	4,98
22	-10,88	32,6	529,4	0,31	0,54	4,97
23	-11,63	34,7	563,5	0,31	0,54	4,97
24	-12,25	36,5	591,9	0,31	0,54	4,97
25	-12,80	37,4	775,1	0,28	0,50	5,77
26	-13,40	39,1	809,5	0,28	0,50	5,76
27	-14,00	40,9	844,0	0,28	0,50	5,75
28	-14,60	42,6	878,7	0,28	0,50	5,75

### 7.3 Calculated Force from a Layer - Left Side

Name	Force
zand los	2,85
zand siltig	105,08
zand los	23,42
leem 1	26,09
zand los	95,49
leem 2	22,95
zand matig vast	143,13
leem 2	0,00
zand los	0,00
zand matig vast	0,00

### 7.4 Calculated Force from a Layer - Right Side

Name	Force
zand siltig	5,65
zand los	46,56
leem 1	51,49
zand los	218,63
leem 2	23,13
zand matig vast	109,23
leem 2	0,00

Name	Force
zand los	0,00
zand matig vast	0,00

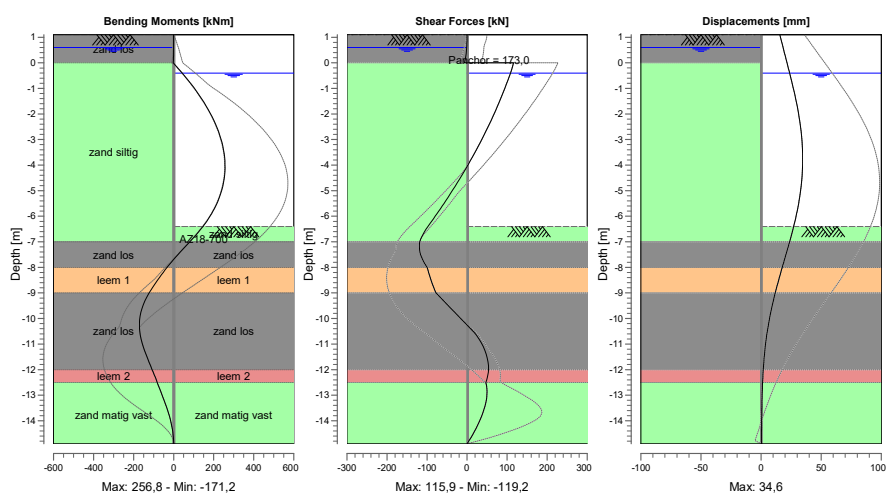
## 7.5 Calculation Results

Number of iterations: 5

### 7.5.1 Charts of Moments, Forces and Displacements

#### Moments/Forces/Displacements - Stage 1: New Stage 1

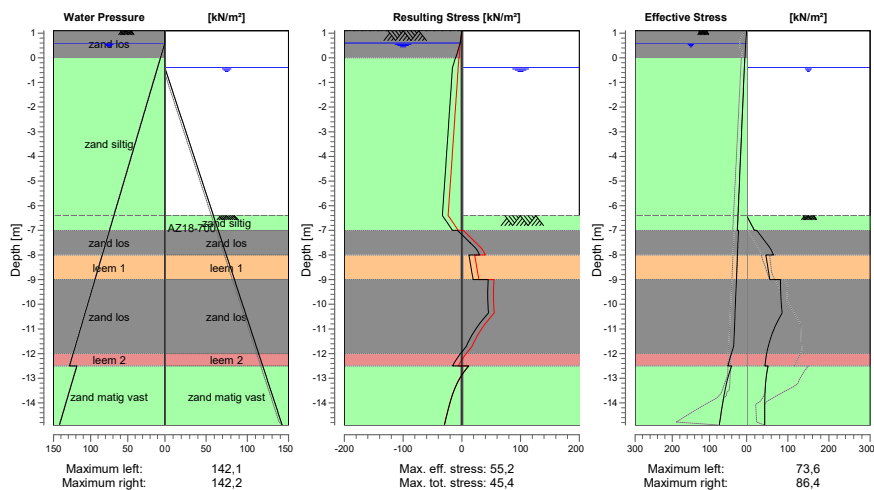
Step 6.5 - Partial factor set: RC 2



### 7.5.2 Charts of Stresses

#### Stress States - Stage 1: New Stage 1

Step 6.5 - Partial factor set: RC 2



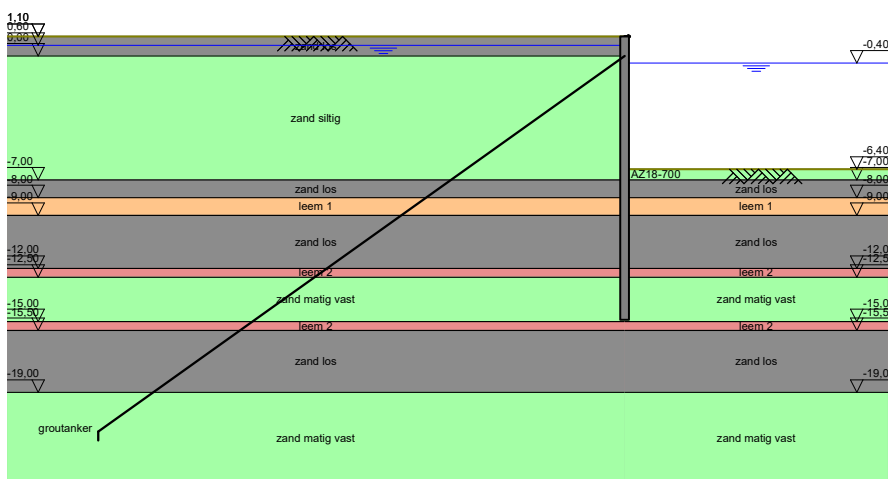
### 7.5.3 Anchors/Struts

Anchor/strut	Level [m]	E-Modulus [kN/m <sup>2</sup> ]	Force [kN]	State	Side	Type
groutanker	0,00	2,100E+08	173,02	Elastic	Left	Anchor



## 8 Outline Stage 2: New Stage 2

Outline - Stage 2: New Stage 2

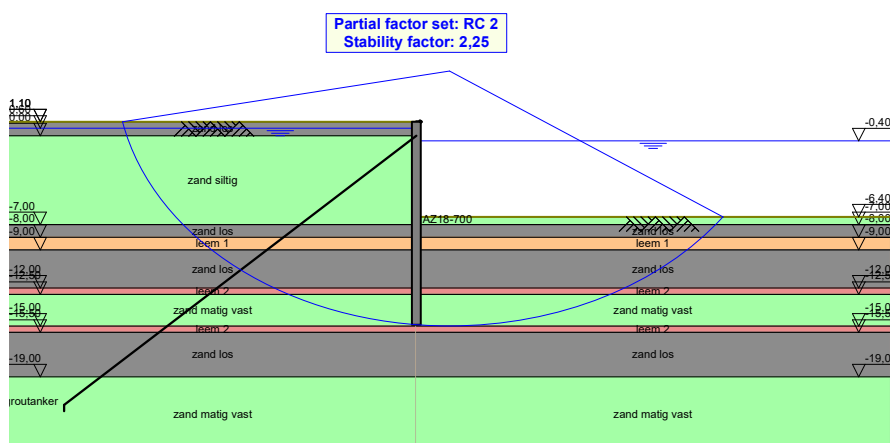


## 9 Overall Stability Stage 2: New Stage 2

Stability factor : 2,25

### 9.1 Overall Stability

Overall Stability - Stage 2: New Stage 2



## 10 Step 6.3 Stage 2: New Stage 2

### 10.1 General Input Data

Pile top displacement: 0,02 [m]  
 Passive side: D-Sheet Piling determined

### 10.2 Input Data Left

#### 10.2.1 Calculation Method

Calculation method: C, phi, delta

#### 10.2.2 Water Level

Water level: 0,65 [m]

#### 10.2.3 Surface

X [m]	Y [m]
0,00	1,10

#### 10.2.4 Soil Material Properties in Profile: kade

Layer name	Level [m]	Unit weight	
		Unsat [kN/m³]	Sat. [kN/m³]
zand los	1,10	18,00	19,00
zand siltig	0,00	17,00	18,00
zand los	-7,00	18,00	19,00
leem 1	-8,00	19,00	18,00
zand los	-9,00	18,00	19,00
leem 2	-12,00	19,00	19,00
zand matig vast	-12,50	18,00	20,00
leem 2	-15,00	19,00	19,00
zand los	-15,50	18,00	19,00
zand matig vast	-19,00	18,00	20,00

Layer name	Level [m]	Cohesion [kN/m²]	Friction angle phi [°]	Delta friction angle*	
				Not reduced [°]	Reduced [°]
zand los	1,10	0,00	23,90	17,38	17,38
zand siltig	0,00	0,00	21,65	13,85	13,85
zand los	-7,00	0,00	23,90	17,38	17,38
leem 1	-8,00	0,00	23,90	17,38	17,38
zand los	-9,00	0,00	23,90	17,38	17,38
leem 2	-12,00	0,00	23,90	17,38	17,38
zand matig vast	-12,50	0,00	26,17	17,45	17,45
leem 2	-15,00	0,00	23,90	17,38	17,38
zand los	-15,50	0,00	23,90	17,38	17,38
zand matig vast	-19,00	0,00	26,17	17,45	17,45

\* The 'not reduced' Delta angle is used for the calculation of the active earth pressure coefficient of Culmann whereas the 'reduced' Delta angle is used for the passive earth pressure coefficient.

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
zand los	1,10	1,00	1,00	Fine
zand siltig	0,00	1,00	1,00	Fine
zand los	-7,00	1,00	1,00	Fine
leem 1	-8,00	1,00	1,00	Fine
zand los	-9,00	1,00	1,00	Fine
leem 2	-12,00	1,00	1,00	Fine

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
zand matig vast	-12,50	1,00	1,00	Fine
leem 2	-15,00	1,00	1,00	Fine
zand los	-15,50	1,00	1,00	Fine
zand matig vast	-19,00	1,00	1,00	Fine

Layer name	Level [m]	Earth pressure coefficients			Additional pore pressure	
		Active [-]	Neutral [-]	Passive [-]	Top [kN/m <sup>2</sup> ]	Bottom [kN/m <sup>2</sup> ]
zand los	1,10	n.a.	n.a.	n.a.	0,00	0,00
zand siltig	0,00	n.a.	n.a.	n.a.	0,00	0,00
zand los	-7,00	n.a.	n.a.	n.a.	0,00	0,00
leem 1	-8,00	n.a.	n.a.	n.a.	0,00	0,00
zand los	-9,00	n.a.	n.a.	n.a.	0,00	0,00
leem 2	-12,00	n.a.	n.a.	n.a.	0,00	0,00
zand matig vast	-12,50	n.a.	n.a.	n.a.	-10,00	-10,00
leem 2	-15,00	n.a.	n.a.	n.a.	-10,00	-10,00
zand los	-15,50	n.a.	n.a.	n.a.	-10,00	-10,00
zand matig vast	-19,00	n.a.	n.a.	n.a.	-10,00	-10,00

### 10.2.5 Modulus of Subgrade Reaction (Secant)

Layer name	Level [m]	Branch 1		Branch 2	
		Top [kN/m <sup>3</sup> ]	Bottom [kN/m <sup>3</sup> ]	Top [kN/m <sup>3</sup> ]	Bottom [kN/m <sup>3</sup> ]
zand los	1,10	9230,77	9230,77	4615,38	4615,38
zand siltig	0,00	9230,77	9230,77	4615,38	4615,38
zand los	-7,00	9230,77	9230,77	4615,38	4615,38
leem 1	-8,00	3076,92	3076,92	1538,46	1538,46
zand los	-9,00	9230,77	9230,77	4615,38	4615,38
leem 2	-12,00	9230,77	9230,77	4615,38	4615,38
zand matig vast	-12,50	15384,62	15384,62	7692,31	7692,31
leem 2	-15,00	9230,77	9230,77	4615,38	4615,38
zand los	-15,50	9230,77	9230,77	4615,38	4615,38
zand matig vast	-19,00	15384,62	15384,62	7692,31	7692,31

Layer name	Level [m]	Branch 3	
		Top [kN/m <sup>3</sup> ]	Bottom [kN/m <sup>3</sup> ]
zand los	1,10	2307,69	2307,69
zand siltig	0,00	2307,69	2307,69
zand los	-7,00	2307,69	2307,69
leem 1	-8,00	615,38	615,38
zand los	-9,00	2307,69	2307,69
leem 2	-12,00	2307,69	2307,69
zand matig vast	-12,50	3846,15	3846,15
leem 2	-15,00	2307,69	2307,69
zand los	-15,50	2307,69	2307,69
zand matig vast	-19,00	3846,15	3846,15

### 10.2.6 Anchors

Name	Level [m]	E-Modulus [kN/m <sup>2</sup> ]	Cross section [m <sup>2</sup> /m]	Length [m]	Angle [°]	Yield force [kN/m]	Pre-tension. force [kN/m]
groutanker	0,00	2,100E+08	1,158E-03	30,00	-45,00	300,00	125,00

### 10.3 Calculated Earth Pressure Coefficients Left

Segment number	Level [m]	Horizontal pressure		Fictive earth pressure coefficients		
		Active [kN/m <sup>2</sup> ]	Passive [kN/m <sup>2</sup> ]	Ka [-]	Ko [-]	Kp [-]
1	1,05	0,3	3,4	0,36	0,59	3,77
2	0,82	1,8	18,7	0,36	0,59	3,77
3	0,63	3,0	31,4	0,36	0,59	3,77
4	0,40	3,7	39,2	0,36	0,59	3,77

Segment number	Level [m]	Horizontal pressure		Fictive earth pressure coefficients		
		Active [kN/m <sup>2</sup> ]	Passive [kN/m <sup>2</sup> ]	Ka [-]	Ko [-]	Kp [-]
5	0,10	4,7	49,6	0,36	0,59	3,77
6	-0,20	6,3	48,5	0,40	0,63	3,09
7	-0,53	7,3	56,6	0,40	0,63	3,08
8	-1,05	9,1	69,6	0,40	0,63	3,08
9	-1,84	11,6	89,5	0,40	0,63	3,07
10	-2,63	14,2	109,4	0,40	0,63	3,07
11	-3,42	16,8	129,3	0,40	0,63	3,07
12	-4,21	19,4	149,2	0,40	0,63	3,07
13	-5,00	22,0	169,2	0,40	0,63	3,07
14	-5,65	24,1	185,4	0,40	0,63	3,07
15	-6,15	25,8	198,0	0,40	0,63	3,07
16	-6,65	27,4	210,6	0,40	0,63	3,07
17	-6,95	28,4	218,1	0,40	0,63	3,07
18	-7,25	26,3	279,9	0,36	0,59	3,80
19	-7,75	28,0	296,7	0,36	0,59	3,79
20	-8,25	29,5	312,8	0,36	0,59	3,78
21	-8,75	31,0	328,0	0,36	0,59	3,78
22	-9,38	33,0	348,5	0,36	0,59	3,78
23	-10,13	35,4	374,3	0,36	0,59	3,78
24	-10,88	37,9	400,2	0,36	0,59	3,77
25	-11,63	40,4	426,1	0,36	0,59	3,77
26	-12,25	42,4	447,7	0,36	0,59	3,77
27	-12,80	44,0	571,2	0,33	0,56	4,26
28	-13,40	46,0	596,9	0,33	0,56	4,26
29	-14,00	48,0	622,7	0,33	0,56	4,26
30	-14,60	50,0	648,5	0,33	0,56	4,26

#### 10.4 Calculated Force from a Layer - Left Side

Name	Force
zand los	4,24
zand siltig	119,66
zand los	27,16
leem 1	30,27
zand los	109,99
leem 2	21,21
zand matig vast	173,42
leem 2	0,00
zand los	0,00
zand matig vast	0,00

#### 10.5 Input Data Right

##### 10.5.1 Calculation Method

Calculation method: Ka, Ko, Kp

##### 10.5.2 Water Level

Water level: -0,65 [m]

##### 10.5.3 Surface

X [m]	Y [m]
0,00	-6,90

##### 10.5.4 Soil Material Properties in Profile: kanaalzijde

Layer name	Level [m]	Unit weight	
		Unsat [kN/m <sup>3</sup> ]	Sat. [kN/m <sup>3</sup> ]
zand siltig	-5,40	17,00	18,00
zand los	-7,00	18,00	19,00

Layer name	Level [m]	Unit weight	
		Unsat [kN/m³]	Sat. [kN/m³]
leem 1	-8,00	19,00	18,00
zand los	-9,00	18,00	19,00
leem 2	-12,00	19,00	19,00
zand matig vast	-12,50	18,00	20,00
leem 2	-15,00	19,00	19,00
zand los	-15,50	18,00	19,00
zand matig vast	-19,00	18,00	20,00

Layer name	Level [m]	Cohesion [kN/m²]	Friction angle phi [°]	Delta friction angle	
				Not reduced [°]	Reduced [°]
zand siltig	-5,40	0,00	21,65	13,85	n.a.
zand los	-7,00	0,00	23,90	17,38	n.a.
leem 1	-8,00	0,00	23,90	17,38	n.a.
zand los	-9,00	0,00	23,90	17,38	n.a.
leem 2	-12,00	0,00	23,90	17,38	n.a.
zand matig vast	-12,50	0,00	26,17	17,45	n.a.
leem 2	-15,00	0,00	23,90	17,38	n.a.
zand los	-15,50	0,00	23,90	17,38	n.a.
zand matig vast	-19,00	0,00	26,17	17,45	n.a.

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
zand siltig	-5,40	1,00	1,00	Fine
zand los	-7,00	1,00	1,00	Fine
leem 1	-8,00	1,00	1,00	Fine
zand los	-9,00	1,00	1,00	Fine
leem 2	-12,00	1,00	1,00	Fine
zand matig vast	-12,50	1,00	1,00	Fine
leem 2	-15,00	1,00	1,00	Fine
zand los	-15,50	1,00	1,00	Fine
zand matig vast	-19,00	1,00	1,00	Fine

Layer name	Level [m]	Earth pressure coefficients			Additional pore pressure	
		Active [-]	Neutral [-]	Passive [-]	Top [kN/m²]	Bottom [kN/m²]
zand siltig	-5,40	0,40	0,63	3,07	0,00	0,00
zand los	-7,00	0,36	0,59	3,77	0,00	0,00
leem 1	-8,00	0,36	0,59	3,77	0,00	0,00
zand los	-9,00	0,36	0,59	3,77	0,00	0,00
leem 2	-12,00	0,36	0,59	3,77	0,00	0,00
zand matig vast	-12,50	0,33	0,56	4,25	0,00	0,00
leem 2	-15,00	0,36	0,59	3,77	0,00	0,00
zand los	-15,50	0,36	0,59	3,77	0,00	0,00
zand matig vast	-19,00	0,33	0,56	4,25	0,00	0,00

#### 10.5.5 Modulus of Subgrade Reaction (Secant)

Layer name	Level [m]	Branch 1		Branch 2	
		Top [kN/m³]	Bottom [kN/m³]	Top [kN/m³]	Bottom [kN/m³]
zand siltig	-5,40	9230,77	9230,77	4615,38	4615,38
zand los	-7,00	9230,77	9230,77	4615,38	4615,38
leem 1	-8,00	3076,92	3076,92	1538,46	1538,46
zand los	-9,00	9230,77	9230,77	4615,38	4615,38
leem 2	-12,00	9230,77	9230,77	4615,38	4615,38
zand matig vast	-12,50	15384,62	15384,62	7692,31	7692,31
leem 2	-15,00	9230,77	9230,77	4615,38	4615,38
zand los	-15,50	9230,77	9230,77	4615,38	4615,38
zand matig vast	-19,00	15384,62	15384,62	7692,31	7692,31

Layer name	Level [m]	Branch 3	
		Top [kN/m³]	Bottom [kN/m³]
zand siltig	-5,40	2307,69	2307,69
zand los	-7,00	2307,69	2307,69
leem 1	-8,00	615,38	615,38
zand los	-9,00	2307,69	2307,69
leem 2	-12,00	2307,69	2307,69
zand matig vast	-12,50	3846,15	3846,15
leem 2	-15,00	2307,69	2307,69
zand los	-15,50	2307,69	2307,69
zand matig vast	-19,00	3846,15	3846,15

## 10.6 Calculated Force from a Layer - Right Side

Name	Force
zand siltig	0,13
zand los	20,41
leem 1	45,71
zand los	275,34
leem 2	46,95
zand matig vast	142,90
leem 2	0,00
zand los	0,00
zand matig vast	0,00

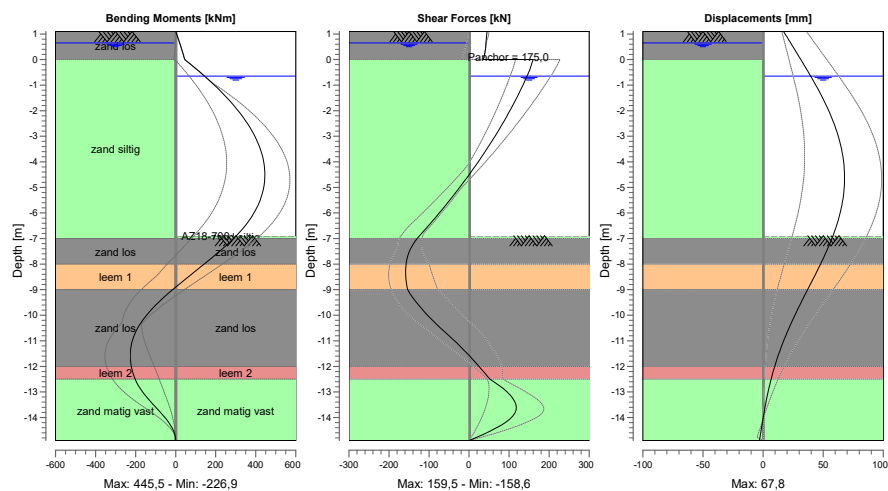
## 10.7 Calculation Results

Number of iterations: 5

### 10.7.1 Charts of Moments, Forces and Displacements

#### Moments/Forces/Displacements - Stage 2: New Stage 2

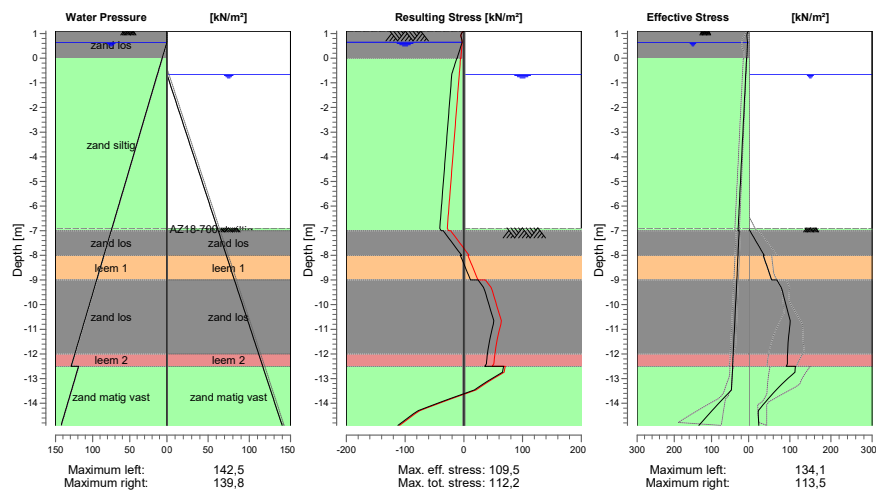
##### Step 6.3 - Partial factor set: RC 2



### 10.7.2 Charts of Stresses

#### Stress States - Stage 2: New Stage 2

##### Step 6.3 - Partial factor set: RC 2



### 10.7.3 Percentage Mobilized Resistance

Horizontal soil pressure	Left [kN]	Right [kN]
Effective	680,3	744,0
Water	1626,9	1394,4
Total	2307,2	2138,4

Considered as passive side	Right
Maximum passive effective resistance	1630,47 kN
Mobilized passive effective resistance	744,01 kN
Percentage mobilized resistance	45,6 %
Position single support	0,00 m
Maximum passive moment	20153,87 kNm
Mobilized passive moment	8309,28 kNm
Percentage mobilized moment	41,2 %

### 10.7.4 Vertical Force Balance

Xi factor	1,39
Partial factor base resistance	1,20
Maximum point resistance	20,000 [MPa]

Vertical force balance unplugged	Force [kN]
Vertical force active	-202,11
Vertical force passive	233,09
Vertical anchor force *	-136,12
Resulting vertical force (no dead weight)	-105,14
Vertical toe capacity $R_{b;d}$	233,33
Vertical toe capacity is sufficient ( $105 \leq 233$ )	



Vertical force balance plugged	Force [kN]
Vertical force active	-202,11
Vertical force passive	233,09
Vertical anchor force	-136,12
Resulting vertical force (no dead weight)	-105,14
Vertical toe capacity $R_{b;d}$	7050,36
Vertical toe capacity is sufficient ( $105 \leq 7050$ )	

\* The vertical anchor force includes a factor of 1.1 as prescribed by art. 9.7.5(a) of Eurocode NEN 9997-1:2016.

#### 10.7.5 Vertical Force Balance - Contribution per Layer

Left			Right		
Level [m]	Layer name	Contribution [kN]	Level [m]	Layer name	Contribution [kN]
1,10	zand los	-1,86	-5,40	zand siltig	0,04
0,00	zand siltig	-41,31	-7,00	zand los	8,94
-7,00	zand los	-11,90	-8,00	leem 1	20,03
-8,00	leem 1	-13,26	-9,00	zand los	120,64
-9,00	zand los	-48,19	-12,00	leem 2	20,57
-12,00	leem 2	-9,29	-12,50	zand matig vast	62,87
-12,50	zand matig vast	-76,29	-15,00	leem 2	0,00
-15,00	leem 2	0,00	-15,50	zand los	0,00
-15,50	zand los	0,00	-19,00	zand matig vast	0,00
-19,00	zand matig vast	0,00			

#### 10.7.6 Anchors/Struts

Anchor/strut	Level [m]	E-Modulus [kN/m <sup>2</sup> ]	Force [kN]	State	Side	Type
groutanker	0,00	2,100E+08	175,00	Elastic	Left	Anchor

## 11 Step 6.5 Stage 2: New Stage 2

### 11.1 Input Data Left

#### 11.1.1 Anchors

Name	Level [m]	E-Modulus [kN/m <sup>2</sup> ]	Cross section [m <sup>2</sup> /m']	Length [m]	Angle [°]	Yield force [kN/m']	Pre-tension. force [kN/m']
groutanker	0,00	2,100E+08	1,158E-03	30,00	-45,00	300,00	125,00

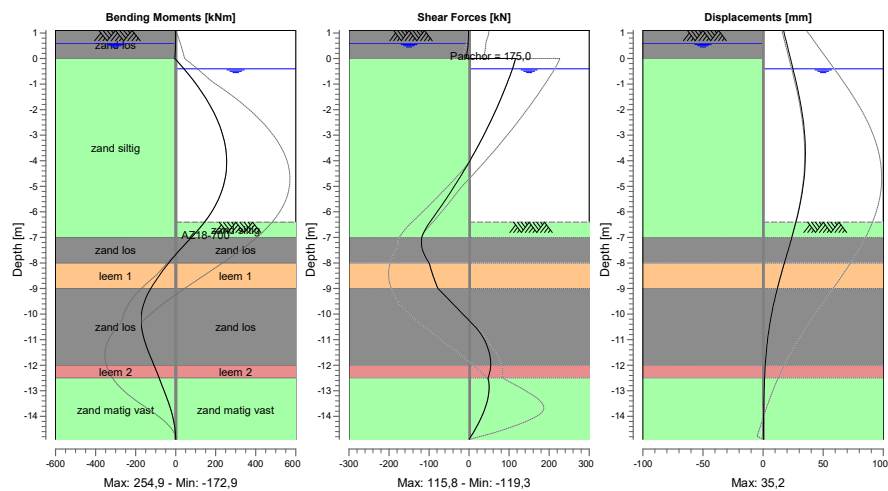
### 11.2 Calculation Results

Number of iterations: 8

#### 11.2.1 Charts of Moments, Forces and Displacements

##### Moments/Forces/Displacements - Stage 2: New Stage 2

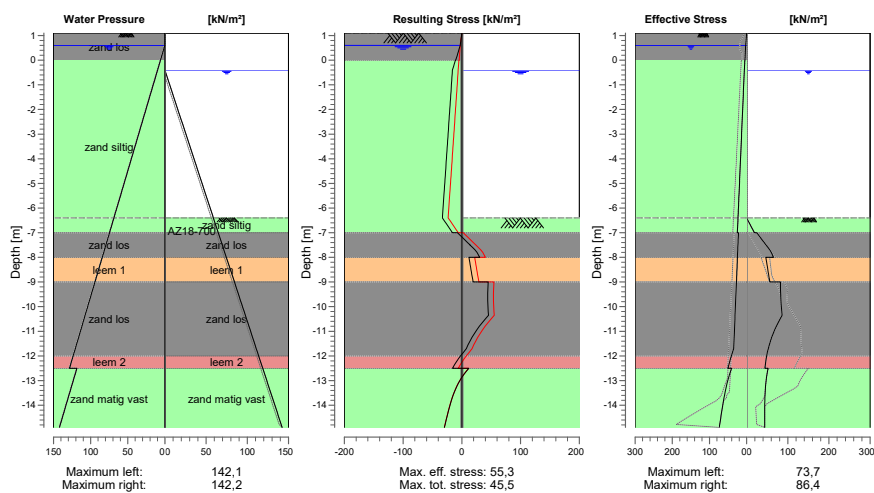
##### Step 6.5 - Partial factor set: RC 2



## 11.2.2 Charts of Stresses

### Stress States - Stage 2: New Stage 2

#### Step 6.5 - Partial factor set: RC 2

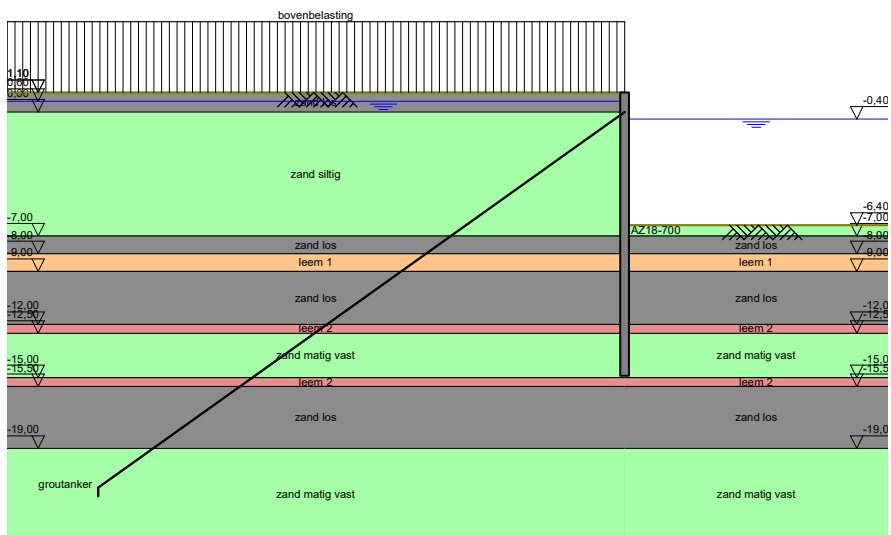


## 11.2.3 Anchors/Struts

Anchor/strut	Level [m]	E-Modulus [kN/m²]	Force [kN]	State	Side	Type
groutanker	0,00	2,100E+08	175,00	Elastic	Left	Anchor

## 12 Outline Stage 3: New Stage 3

Outline - Stage 3: New Stage 3

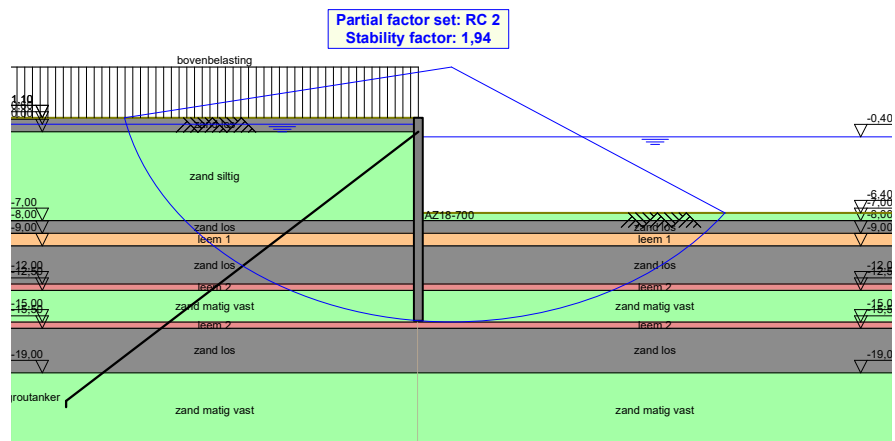


## 13 Overall Stability Stage 3: New Stage 3

Stability factor : 1,94

### 13.1 Overall Stability

Overall Stability - Stage 3: New Stage 3



## 14 Step 6.3 Stage 3: New Stage 3

### 14.1 General Input Data

Passive side:

D-Sheet Piling determined

### 14.2 Input Data Left

#### 14.2.1 Calculation Method

Calculation method: C, phi, delta

#### 14.2.2 Water Level

Water level: 0,65 [m]

#### 14.2.3 Surface

X [m]	Y [m]
0,00	1,10

#### 14.2.4 Soil Material Properties in Profile: kade

Layer name	Level [m]	Unit weight	
		Unsat [kN/m³]	Sat. [kN/m³]
zand los	1,10	18,00	19,00
zand siltig	0,00	17,00	18,00
zand los	-7,00	18,00	19,00
leem 1	-8,00	19,00	18,00
zand los	-9,00	18,00	19,00
leem 2	-12,00	19,00	19,00
zand matig vast	-12,50	18,00	20,00
leem 2	-15,00	19,00	19,00
zand los	-15,50	18,00	19,00
zand matig vast	-19,00	18,00	20,00

Layer name	Level [m]	Cohesion [kN/m²]	Friction angle phi [°]	Delta friction angle*	
				Not reduced [°]	Reduced [°]
zand los	1,10	0,00	23,90	17,38	17,38
zand siltig	0,00	0,00	21,65	13,85	13,85
zand los	-7,00	0,00	23,90	17,38	17,38
leem 1	-8,00	0,00	23,90	17,38	17,38
zand los	-9,00	0,00	23,90	17,38	17,38
leem 2	-12,00	0,00	23,90	17,38	17,38
zand matig vast	-12,50	0,00	26,17	17,45	17,45
leem 2	-15,00	0,00	23,90	17,38	17,38
zand los	-15,50	0,00	23,90	17,38	17,38
zand matig vast	-19,00	0,00	26,17	17,45	17,45

\* The 'not reduced' Delta angle is used for the calculation of the active earth pressure coefficient of Culmann whereas the 'reduced' Delta angle is used for the passive earth pressure coefficient.

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
zand los	1,10	1,00	1,00	Fine
zand siltig	0,00	1,00	1,00	Fine
zand los	-7,00	1,00	1,00	Fine
leem 1	-8,00	1,00	1,00	Fine
zand los	-9,00	1,00	1,00	Fine
leem 2	-12,00	1,00	1,00	Fine
zand matig vast	-12,50	1,00	1,00	Fine

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
leem 2	-15,00	1,00	1,00	Fine
zand los	-15,50	1,00	1,00	Fine
zand matig vast	-19,00	1,00	1,00	Fine

Layer name	Level [m]	Earth pressure coefficients			Additional pore pressure	
		Active [-]	Neutral [-]	Passive [-]	Top [kN/m²]	Bottom [kN/m²]
zand los	1,10	n.a.	n.a.	n.a.	0,00	0,00
zand siltig	0,00	n.a.	n.a.	n.a.	0,00	0,00
zand los	-7,00	n.a.	n.a.	n.a.	0,00	0,00
leem 1	-8,00	n.a.	n.a.	n.a.	0,00	0,00
zand los	-9,00	n.a.	n.a.	n.a.	0,00	0,00
leem 2	-12,00	n.a.	n.a.	n.a.	0,00	0,00
zand matig vast	-12,50	n.a.	n.a.	n.a.	-10,00	-10,00
leem 2	-15,00	n.a.	n.a.	n.a.	-10,00	-10,00
zand los	-15,50	n.a.	n.a.	n.a.	-10,00	-10,00
zand matig vast	-19,00	n.a.	n.a.	n.a.	-10,00	-10,00

#### 14.2.5 Modulus of Subgrade Reaction (Secant)

Layer name	Level [m]	Branch 1		Branch 2	
		Top [kN/m³]	Bottom [kN/m³]	Top [kN/m³]	Bottom [kN/m³]
zand los	1,10	9230,77	9230,77	4615,38	4615,38
zand siltig	0,00	9230,77	9230,77	4615,38	4615,38
zand los	-7,00	9230,77	9230,77	4615,38	4615,38
leem 1	-8,00	3076,92	3076,92	1538,46	1538,46
zand los	-9,00	9230,77	9230,77	4615,38	4615,38
leem 2	-12,00	9230,77	9230,77	4615,38	4615,38
zand matig vast	-12,50	15384,62	15384,62	7692,31	7692,31
leem 2	-15,00	9230,77	9230,77	4615,38	4615,38
zand los	-15,50	9230,77	9230,77	4615,38	4615,38
zand matig vast	-19,00	15384,62	15384,62	7692,31	7692,31

Layer name	Level [m]	Branch 3	
		Top [kN/m³]	Bottom [kN/m³]
zand los	1,10	2307,69	2307,69
zand siltig	0,00	2307,69	2307,69
zand los	-7,00	2307,69	2307,69
leem 1	-8,00	615,38	615,38
zand los	-9,00	2307,69	2307,69
leem 2	-12,00	2307,69	2307,69
zand matig vast	-12,50	3846,15	3846,15
leem 2	-15,00	2307,69	2307,69
zand los	-15,50	2307,69	2307,69
zand matig vast	-19,00	3846,15	3846,15

#### 14.2.6 Anchors

Name	Level [m]	E-Modulus [kN/m²]	Cross section [m²/m']	Length [m]	Angle [°]	Yield force [kN/m']	Pre-tension. force [kN/m']
groutanker	0,00	2,100E+08	1,158E-03	30,00	-45,00	300,00	n.a.

#### 14.2.7 Uniform Loads

Name	Characteristic load [kN/m²]	Favourable / Unfavourable	Permanent / Variable
bovenbelasting	22,00	Unfavourable	Variable

### 14.3 Calculated Earth Pressure Coefficients Left

Segment number	Level [m]	Horizontal pressure		Fictive earth pressure coefficients		
		Active [kN/m <sup>2</sup> ]	Passive [kN/m <sup>2</sup> ]	Ka [-]	Ko [-]	Kp [-]
1	1,05	8,2	86,3	0,36	0,59	3,77
2	0,82	9,6	101,6	0,36	0,59	3,77
3	0,63	10,8	114,4	0,36	0,59	3,77
4	0,40	11,6	122,1	0,36	0,59	3,77
5	0,10	12,6	132,5	0,36	0,59	3,77
6	-0,20	15,1	116,5	0,40	0,63	3,09
7	-0,53	16,1	124,5	0,40	0,63	3,08
8	-1,05	17,9	137,4	0,40	0,63	3,08
9	-1,84	20,4	157,2	0,40	0,63	3,08
10	-2,63	23,0	177,1	0,40	0,63	3,07
11	-3,42	25,6	197,0	0,40	0,63	3,07
12	-4,21	28,2	216,9	0,40	0,63	3,07
13	-5,00	30,8	236,8	0,40	0,63	3,07
14	-5,65	32,9	253,0	0,40	0,63	3,07
15	-6,15	34,6	265,6	0,40	0,63	3,07
16	-6,65	36,2	278,2	0,40	0,63	3,07
17	-6,95	37,2	285,7	0,40	0,63	3,07
18	-7,25	34,2	363,2	0,36	0,59	3,79
19	-7,75	35,8	380,0	0,36	0,59	3,79
20	-8,25	37,4	396,1	0,36	0,59	3,78
21	-8,75	38,9	411,2	0,36	0,59	3,78
22	-9,38	40,8	431,7	0,36	0,59	3,78
23	-10,13	43,3	457,5	0,36	0,59	3,78
24	-10,88	45,8	483,3	0,36	0,59	3,78
25	-11,63	48,2	509,2	0,36	0,59	3,77
26	-12,25	50,3	530,8	0,36	0,59	3,77
27	-12,80	51,2	665,3	0,33	0,56	4,26
28	-13,40	53,2	690,9	0,33	0,56	4,26
29	-14,00	55,2	716,6	0,33	0,56	4,26
30	-14,60	57,3	742,4	0,33	0,56	4,26

### 14.4 Calculated Force from a Layer - Left Side

Name	Force
zand los	11,88
zand siltig	181,25
zand los	35,02
leem 1	38,13
zand los	133,58
leem 2	25,14
zand matig vast	208,55
leem 2	0,00
zand los	0,00
zand matig vast	0,00

### 14.5 Input Data Right

#### 14.5.1 Calculation Method

Calculation method: Ka, Ko, Kp

#### 14.5.2 Water Level

Water level: -0,65 [m]



### 14.5.3 Surface

X [m]	Y [m]
0,00	-6,90

### 14.5.4 Soil Material Properties in Profile: kanaalzijde

Layer name	Level [m]	Unit weight	
		Unsat [kN/m³]	Sat. [kN/m³]
zand siltig	-5,40	17,00	18,00
zand los	-7,00	18,00	19,00
leem 1	-8,00	19,00	18,00
zand los	-9,00	18,00	19,00
leem 2	-12,00	19,00	19,00
zand matig vast	-12,50	18,00	20,00
leem 2	-15,00	19,00	19,00
zand los	-15,50	18,00	19,00
zand matig vast	-19,00	18,00	20,00

Layer name	Level [m]	Cohesion [kN/m²]	Friction angle phi [°]	Delta friction angle	
				Not reduced [°]	Reduced [°]
zand siltig	-5,40	0,00	21,65	13,85	n.a.
zand los	-7,00	0,00	23,90	17,38	n.a.
leem 1	-8,00	0,00	23,90	17,38	n.a.
zand los	-9,00	0,00	23,90	17,38	n.a.
leem 2	-12,00	0,00	23,90	17,38	n.a.
zand matig vast	-12,50	0,00	26,17	17,45	n.a.
leem 2	-15,00	0,00	23,90	17,38	n.a.
zand los	-15,50	0,00	23,90	17,38	n.a.
zand matig vast	-19,00	0,00	26,17	17,45	n.a.

Layer name	Level [m]	Shell factor [-]	OCR [-]	Grain type
zand siltig	-5,40	1,00	1,00	Fine
zand los	-7,00	1,00	1,00	Fine
leem 1	-8,00	1,00	1,00	Fine
zand los	-9,00	1,00	1,00	Fine
leem 2	-12,00	1,00	1,00	Fine
zand matig vast	-12,50	1,00	1,00	Fine
leem 2	-15,00	1,00	1,00	Fine
zand los	-15,50	1,00	1,00	Fine
zand matig vast	-19,00	1,00	1,00	Fine

Layer name	Level [m]	Earth pressure coefficients			Additional pore pressure	
		Active [-]	Neutral [-]	Passive [-]	Top [kN/m²]	Bottom [kN/m²]
zand siltig	-5,40	0,40	0,63	3,07	0,00	0,00
zand los	-7,00	0,36	0,59	3,77	0,00	0,00
leem 1	-8,00	0,36	0,59	3,77	0,00	0,00
zand los	-9,00	0,36	0,59	3,77	0,00	0,00
leem 2	-12,00	0,36	0,59	3,77	0,00	0,00
zand matig vast	-12,50	0,33	0,56	4,25	0,00	0,00
leem 2	-15,00	0,36	0,59	3,77	0,00	0,00
zand los	-15,50	0,36	0,59	3,77	0,00	0,00
zand matig vast	-19,00	0,33	0,56	4,25	0,00	0,00

### 14.5.5 Modulus of Subgrade Reaction (Secant)

Layer name	Level [m]	Branch 1		Branch 2	
		Top [kN/m³]	Bottom [kN/m³]	Top [kN/m³]	Bottom [kN/m³]
zand siltig	-5,40	9230,77	9230,77	4615,38	4615,38
zand los	-7,00	9230,77	9230,77	4615,38	4615,38
leem 1	-8,00	3076,92	3076,92	1538,46	1538,46

Layer name	Level [m]	Branch 1		Branch 2	
		Top [kN/m³]	Bottom [kN/m³]	Top [kN/m³]	Bottom [kN/m³]
zand los	-9,00	9230,77	9230,77	4615,38	4615,38
leem 2	-12,00	9230,77	9230,77	4615,38	4615,38
zand matig vast	-12,50	15384,62	15384,62	7692,31	7692,31
leem 2	-15,00	9230,77	9230,77	4615,38	4615,38
zand los	-15,50	9230,77	9230,77	4615,38	4615,38
zand matig vast	-19,00	15384,62	15384,62	7692,31	7692,31

Layer name	Level [m]	Branch 3	
		Top [kN/m³]	Bottom [kN/m³]
zand siltig	-5,40	2307,69	2307,69
zand los	-7,00	2307,69	2307,69
leem 1	-8,00	615,38	615,38
zand los	-9,00	2307,69	2307,69
leem 2	-12,00	2307,69	2307,69
zand matig vast	-12,50	3846,15	3846,15
leem 2	-15,00	2307,69	2307,69
zand los	-15,50	2307,69	2307,69
zand matig vast	-19,00	3846,15	3846,15

#### 14.6 Calculated Force from a Layer - Right Side

Name	Force
zand siltig	0,13
zand los	20,41
leem 1	49,63
zand los	314,32
leem 2	55,70
zand matig vast	182,94
leem 2	0,00
zand los	0,00
zand matig vast	0,00

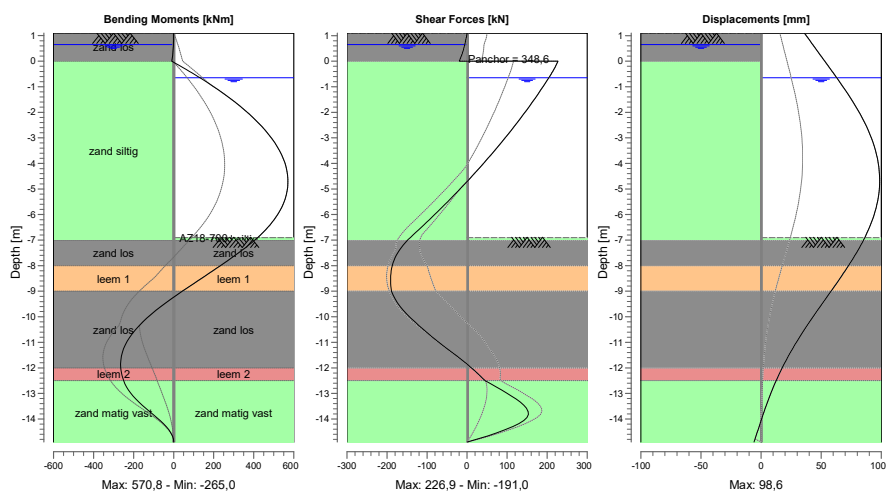
#### 14.7 Calculation Results

Number of iterations: 5

### 14.7.1 Charts of Moments, Forces and Displacements

#### Moments/Forces/Displacements - Stage 3: New Stage 3

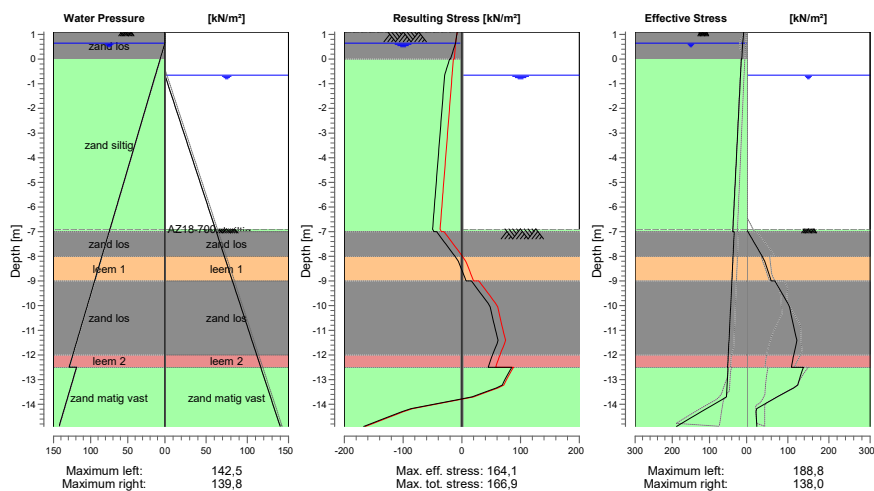
##### Step 6.3 - Partial factor set: RC 2



### 14.7.2 Charts of Stresses

#### Stress States - Stage 3: New Stage 3

##### Step 6.3 - Partial factor set: RC 2



**14.7.3 Percentage Mobilized Resistance**

Horizontal soil pressure	Left [kN]	Right [kN]
Effective	887,0	872,4
Water	1626,9	1394,4
Total	2513,8	2266,8

Considered as passive side	Right
Maximum passive effective resistance	1630,47 kN
Mobilized passive effective resistance	872,38 kN
Percentage mobilized resistance	53,5 %
Position single support	0,00 m
Maximum passive moment	20153,87 kNm
Mobilized passive moment	9845,55 kNm
Percentage mobilized moment	48,9 %

**14.7.4 Vertical Force Balance**

Xi factor	1,39
Partial factor base resistance	1,20
Maximum point resistance	20,000 [MPa]

Vertical force balance unplugged	Force [kN]
Vertical force active	-261,13
Vertical force passive	273,34
Vertical anchor force *	-271,12
Resulting vertical force (no dead weight)	-258,91
Vertical toe capacity R <sub>b;d</sub>	233,33
Vertical toe capacity is not sufficient (259 > 233)	

Vertical force balance plugged	Force [kN]
Vertical force active	-261,13
Vertical force passive	273,34
Vertical anchor force	-271,12
Resulting vertical force (no dead weight)	-258,91
Vertical toe capacity R <sub>b;d</sub>	7050,36
Vertical toe capacity is sufficient (259 ≤ 7050)	

\* The vertical anchor force includes a factor of 1.1 as prescribed by art. 9.7.5(a) of Eurocode NEN 9997-1:2016.

**14.7.5 Vertical Force Balance - Contribution per Layer**

Left			Right		
Level [m]	Layer name	Contribution [kN]	Level [m]	Layer name	Contribution [kN]
1,10	zand los	-5,20	-5,40	zand siltig	0,04
0,00	zand siltig	-62,58	-7,00	zand los	8,94
-7,00	zand los	-15,34	-8,00	leem 1	21,75
-8,00	leem 1	-16,71	-9,00	zand los	137,72
-9,00	zand los	-58,53	-12,00	leem 2	24,41
-12,00	leem 2	-11,01	-12,50	zand matig vast	80,48
-12,50	zand matig vast	-91,75	-15,00	leem 2	0,00
-15,00	leem 2	0,00	-15,50	zand los	0,00
-15,50	zand los	0,00	-19,00	zand matig vast	0,00
-19,00	zand matig vast	0,00			

**14.7.6 Anchors/Struts**

Anchor/strut	Level [m]	E-Modulus [kN/m²]	Force [kN]	State	Side	Type
groutanker	0,00	2,100E+08	348,57	Elastic	Left	Anchor

## 15 Step 6.5 Stage 3: New Stage 3

### 15.1 Input Data Left

#### 15.1.1 Anchors

Name	Level [m]	E-Modulus [kN/m <sup>2</sup> ]	Cross section [m <sup>2</sup> /m']	Length [m]	Angle [°]	Yield force [kN/m']	Pre-tension. force [kN/m']
groutanker	0,00	2,100E+08	1,158E-03	30,00	-45,00	300,00	n.a.

#### 15.1.2 Uniform Loads

Name	Characteristic load [kN/m <sup>2</sup> ]	Favourable / Unfavourable	Permanent / Variable
bovenbelasting	20,00	Unfavourable	Variable

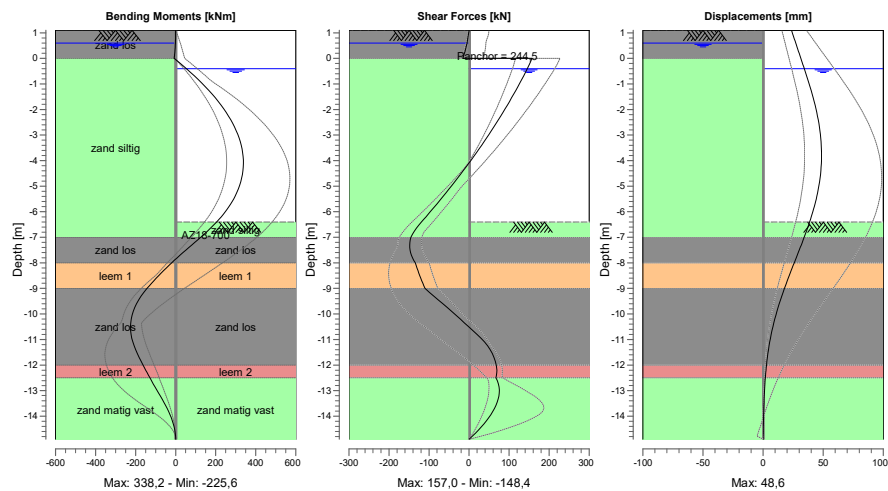
### 15.2 Calculation Results

Number of iterations: 5

#### 15.2.1 Charts of Moments, Forces and Displacements

##### Moments/Forces/Displacements - Stage 3: New Stage 3

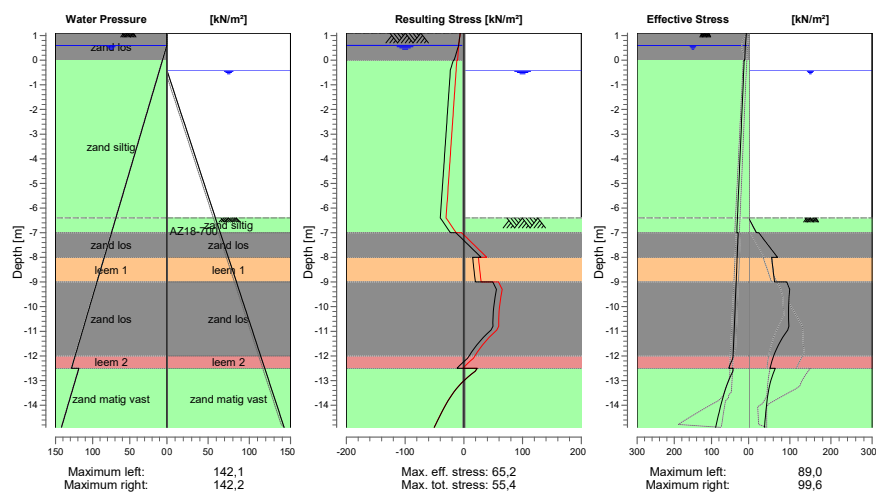
Step 6.5 - Partial factor set: RC 2



## 15.2.2 Charts of Stresses

### Stress States - Stage 3: New Stage 3

#### Step 6.5 - Partial factor set: RC 2



## 15.2.3 Anchors/Struts

Anchor/strut	Level [m]	E-Modulus [kN/m²]	Force [kN]	State	Side	Type
groutanker	0,00	2,100E+08	244,48	Elastic	Left	Anchor

## End of Report

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Revisie:

4942-02  
**0.0**

Opdrachtgever:

Gemeente Zaanstad  
Stadhuisplein 100  
1506 MZ Zaandam

Projectnummer:

24-4942

Werk:

Stalen damwand Gerrit Bolkade Zaandam  
Berekening stalen damwand

Onderdeel:

**Bijlage 2**  
**sonderingen Willem Thomassenhaven**  
**Lankelma**

Datum:

27 mei 2024

Opdrachtgever: Gemeente Zaanstad  
Afd Realisatie  
Zaandam

Contactpersoon:




Datum rapport: 24 juli 2014

Projectnummer: 1418279

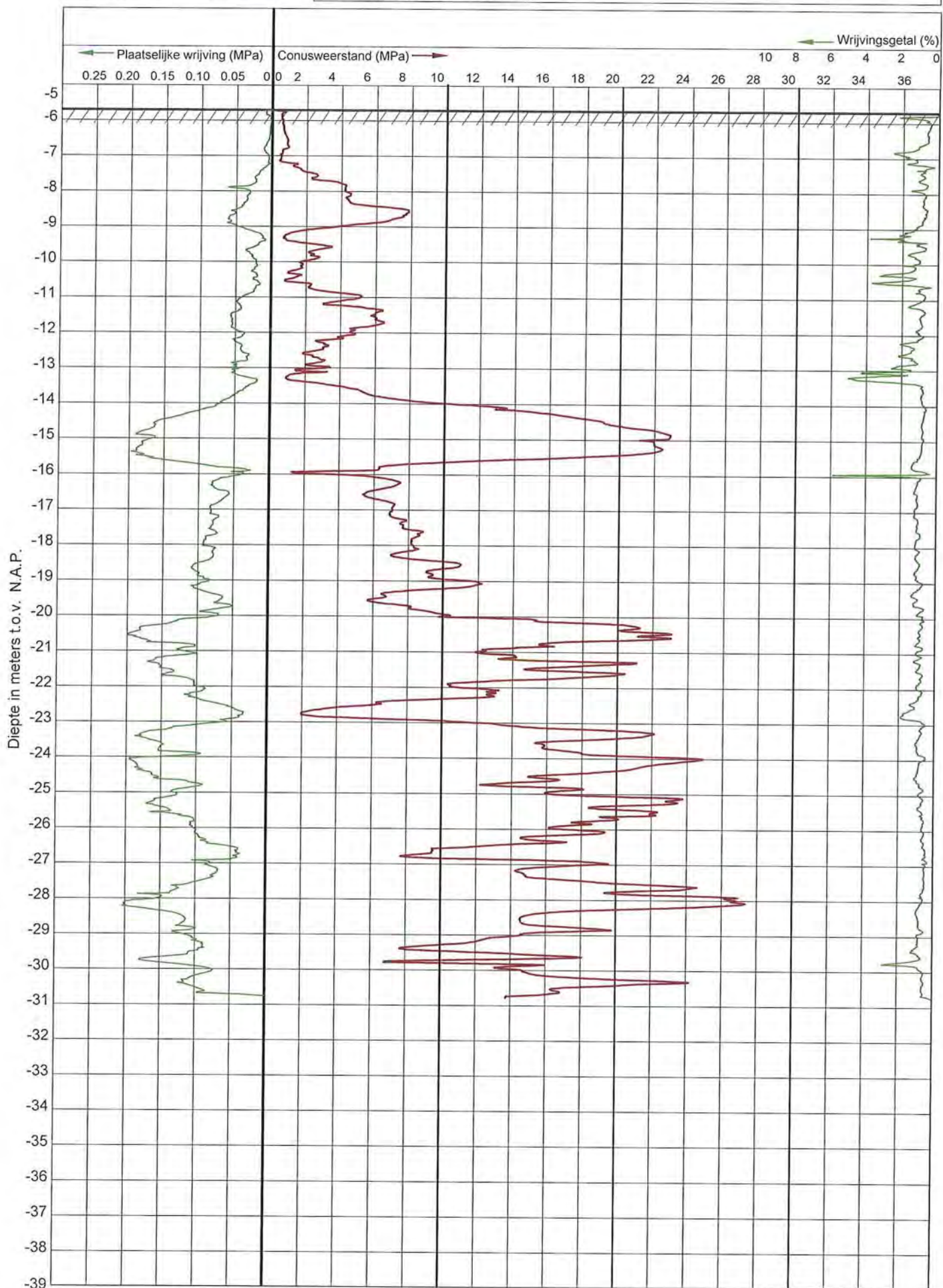
Bijzonderheden: Aanduiding: Maaiveld op Sondering = waterbodem

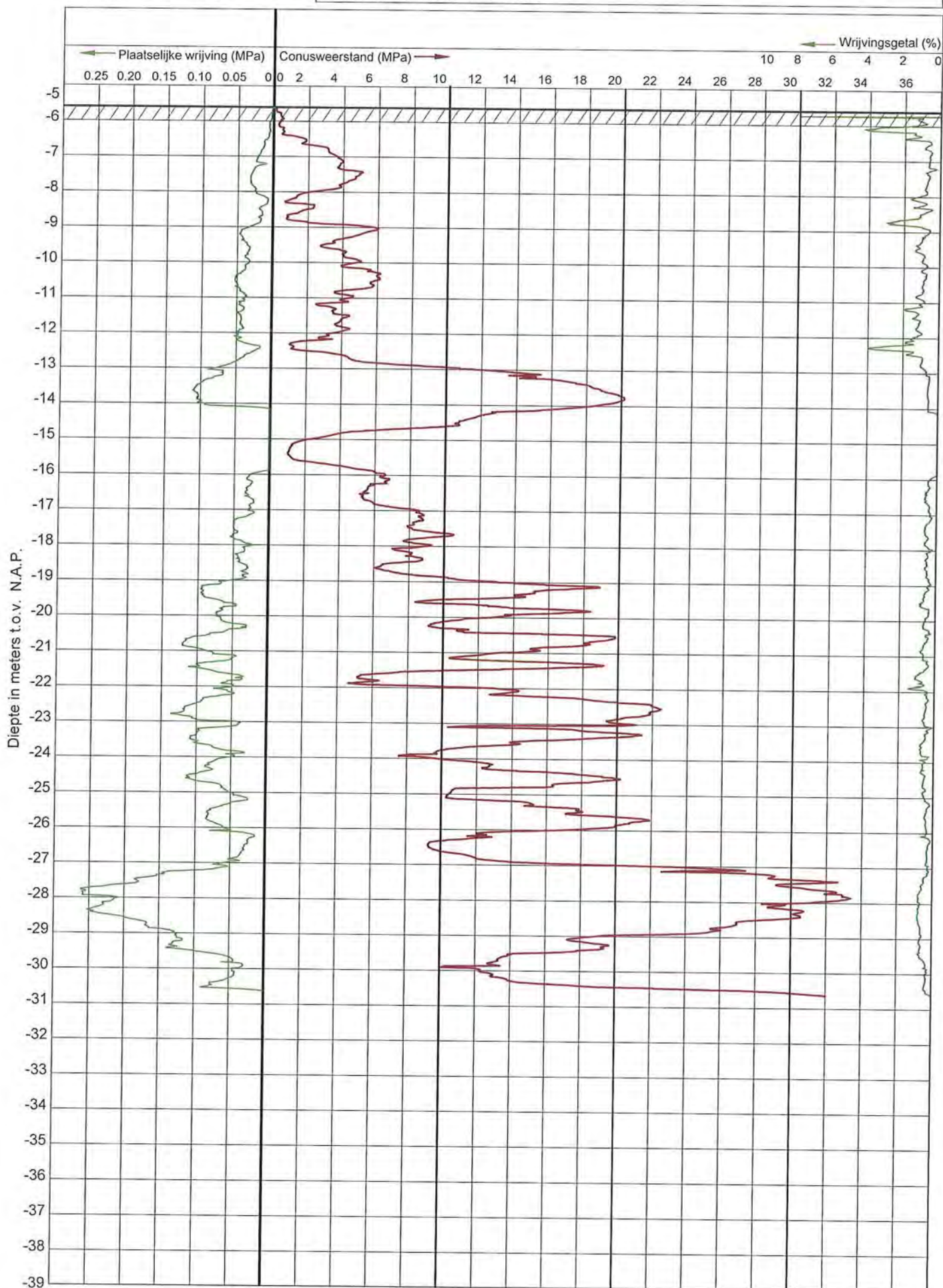
Bijlagen: 5 sonderingen Wim Thomassen Haven  
3 sonderingen Oude Haven  
1 situatieschets  
Toelichting grondonderzoek

### Grondonderzoek aan de Wim Thomassen en Oude Haven te Zaandam

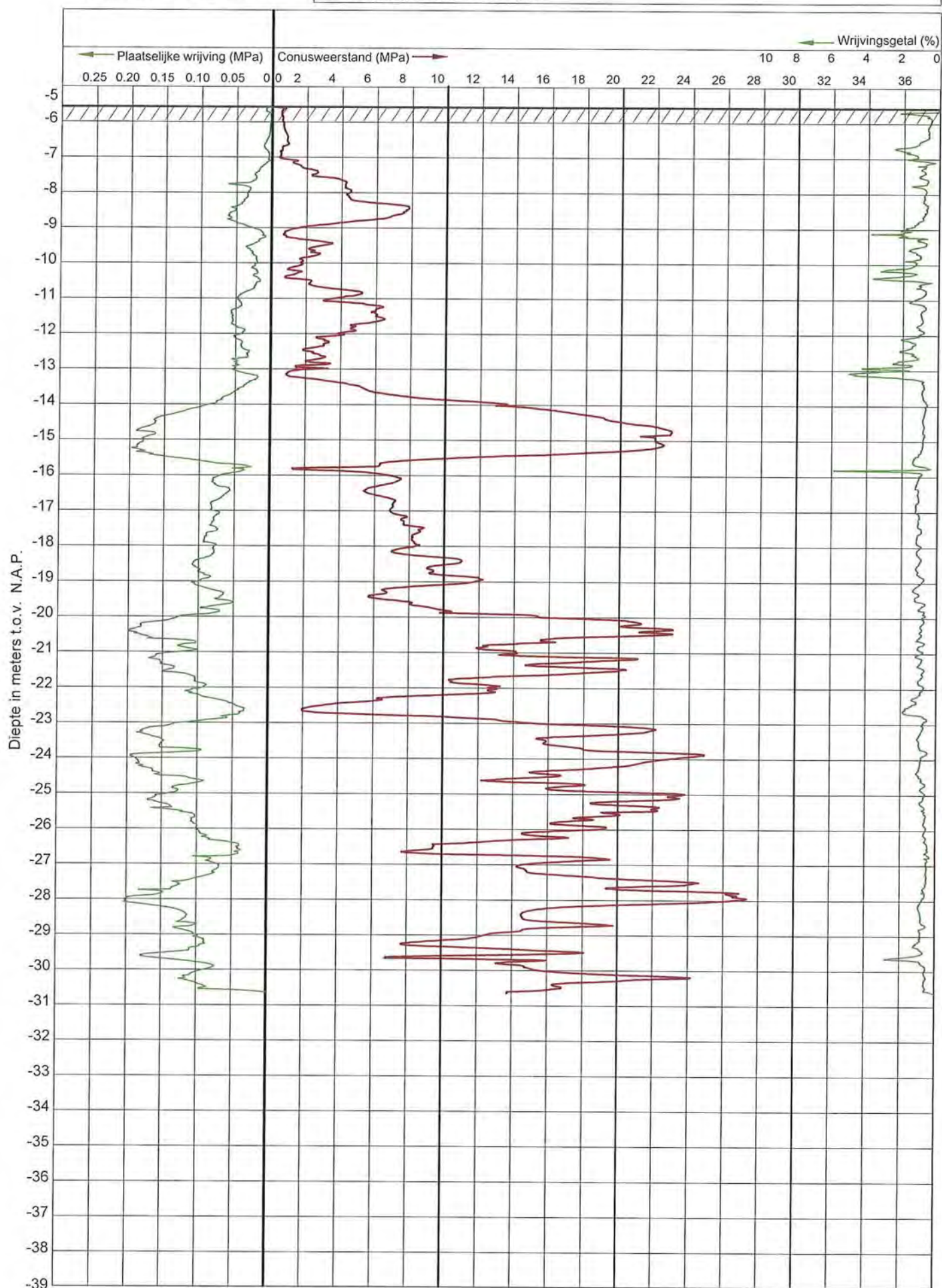
Versie	Datum	Omschrijving	Paraaf projectleider
1	24-7-2014	Eerste versie	
2	24-7-2014	Definitieve versie	

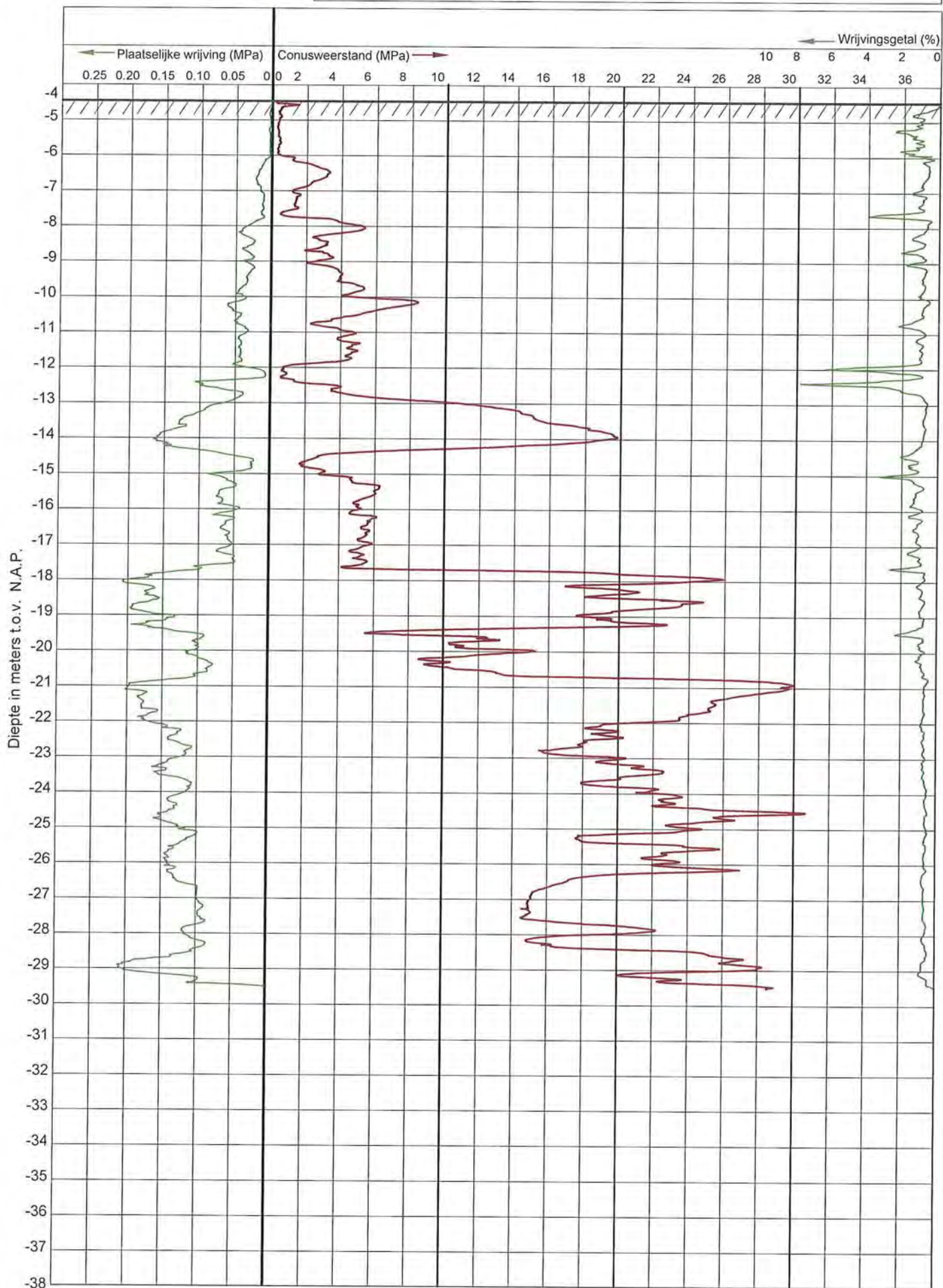




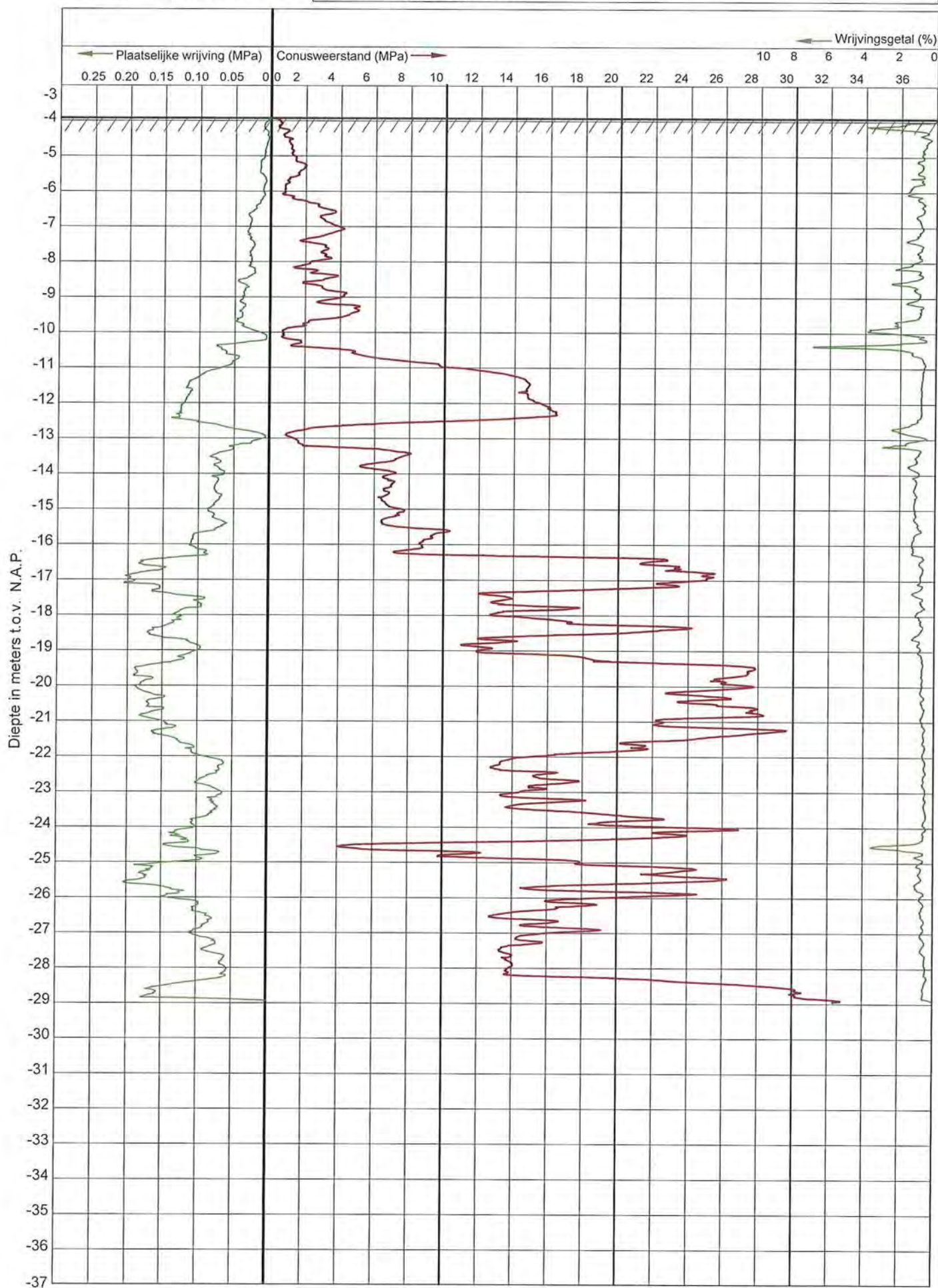


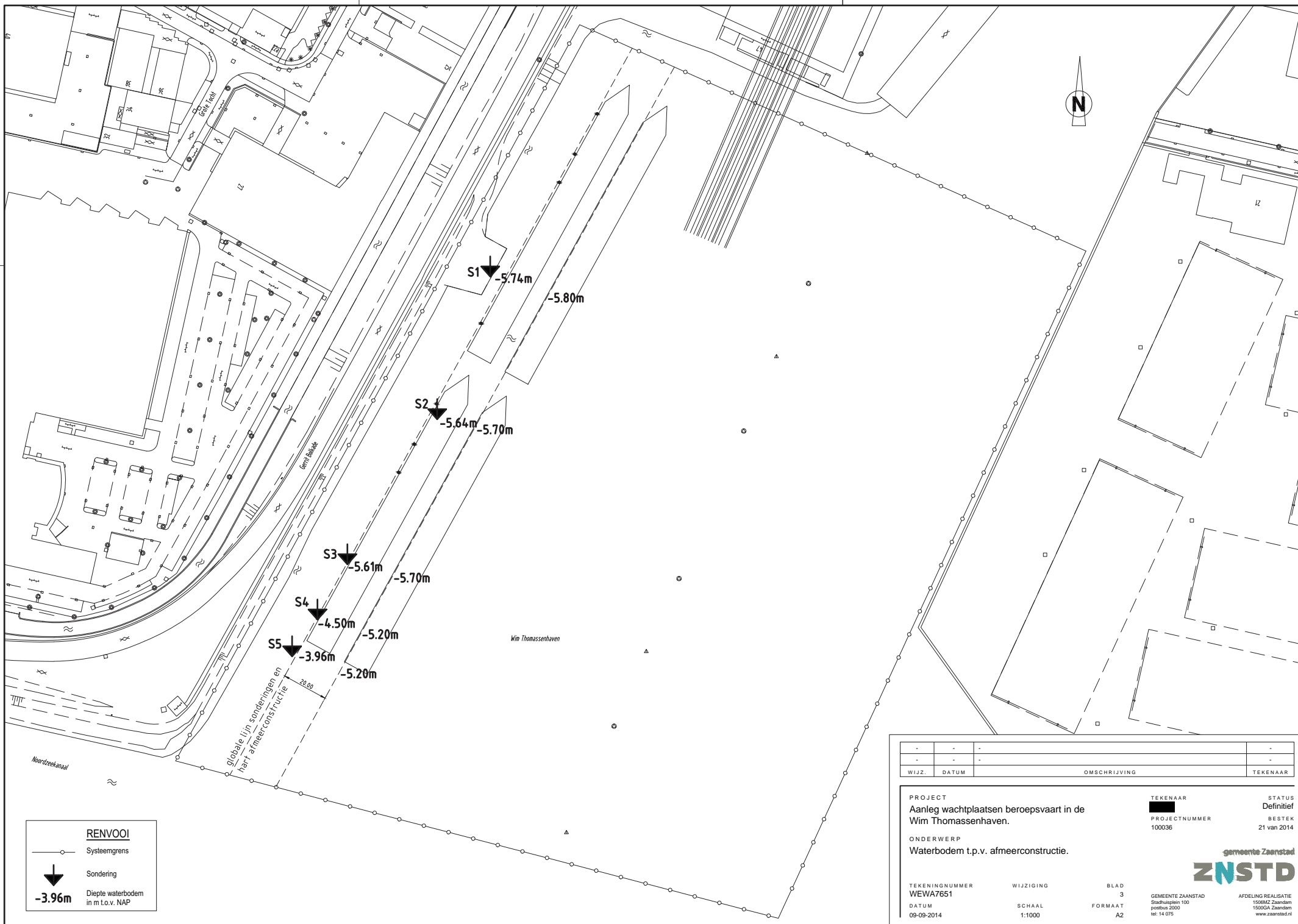












## Waterhuishouding Noordzeekanaal

Maatgevend stilwaterstand inclusief robuustheidstoeslag: +1,70 m N.A.P.

Maximaal peil (1/10.000): +1,40 m N.A.P.

Maximaal peil (1/1.000): +0,40 m N.A.P.

Streefpeil: -0,40 m N.A.P.

Peil bij calamiteit op het Noordzeekanaal: -0,95 m N.A.P.